

Computation Department

M-026

LTSS

Livermore
Time-Sharing
System

PART I: OCTOPUS

CHAPTER 9: CDC 6600 SYSTEM CALLS AND I/O
REQUESTS

Marilyn D. Richards, et al.

Edition 3: May 27, 1969

Change 4: January 29, 1974



LAWRENCE
LIVERMORE
LABORATORY
University of California

LTSS

January 29, 1974

M-026

To: All Holders of LTSS-9

From: Harriet Coverston

Subject: Change 4 to LTSS-9, CDC 6600 System Calls and I/O Requests,
Edition 3, May 27, 1969.

A new FROST system 576 was put on the G machine January 29, 1974. This system has the following new features and changes. Where the changes affect LTSS-9, the page number is shown and the change page is attached.

- 1) System 576 implements an execute-only file. An execute-only file can be executed but not accessed.
 - Create call, p. 6
 - Open call, p. 9
 - Close call, p. 26
- 2) New options have been added to the Create call that allow single or multiple access to a pack. These are restricted options. (See p. 6.)
- 3) Divisional file packs can be taken in and out of the system. (Operations change; no pages affected.)
- 4) System 576 fixes a system bug. An error return (SS=10) will be returned if a user tries to create a file at a level greater than K (7), or if the level is not a legal level for the operating machine. Prior systems set SS=10, but gave a good return. (Operations change; no pages affected.)
 - Legal G machine unclassified levels: U (1), A (3), K (7).
 - Legal G machine classified levels: U (1), P (2), A (3), K (7).
 - Legal L machine levels: U (1), P (2), A (3), S (5), K (7).

Please insert the change pages indicated below into your copy of LTSS-9. Discard the replaced pages, and insert this transmittal letter before the title page of the chapter. Changes to a page are indicated by the black change bars in the margin.

Cover	6a
Title	9
1a	13
1b	24
4a	26
4b	54
6	55

Harriet G. Coverston, Ext. 3098
Worker Systems Group

RAC/lh

LTSS

M-026

December 14, 1973

To: All Holders of LTSS-9
Subject: Change 3 to LTSS-9, CDC 6600 System Calls and I/O Requests,
Edition 3: May 27, 1969, Change 2: September 15, 1972.
From: Harriet Coverston

Attached are replacement pages for LTSS-9, Edition 3. Changes or corrections are indicated by black bars in the margin.

Public files are distinguished by user number = 000000. All users can access these files, but only user 999998 can change the status of a Public file.

Divisional files are also distinguished by user number = 000000. However, each divisional file has an owner division associated with it. There are two types of divisional files:

1. Global Access – all users may access this divisional file, but only the users belonging to the owner division may change the status of this file.
2. Restricted Access – only the users belonging to the owner division may access this divisional file. Also only the users belonging to the owner division may change the status of the file. Both types of divisional files may have a protection level specified. This effectively limits access to those users (Global or Restricted) logged in at the file level or higher than the file level.

Harriet Coverston, Ext. 3098
Worker Systems Group

RAC/lh

Interdepartmental letterhead

Mail Station L - -9

Ext: 7679

October 20, 1972

To: All holders of LTSS-9 (Ed. 3, Change 2), CDC-6600
System Calls and I/O Requests
From: Keith A. Dawson
Subject: Errata 1
Replacement Notice: This document supersedes Octopus Communique No.
311, Sept. 30, 1970.

Please make the following corrections to your copy of LTSS-9.

Page 1b

Add OC-311 (Sept. 30, 1970) to the list of superseded communiques.

Before page 4

Attach the enclosed page 3b (this page was inadvertently left out at the last revision).

Page 6

Add at bottom of page: "SS=10 LL was too large (>7)."

Page 24

Replace text lines 5 and 6 with:

"7's or 2's stored in BETA (7's if the PP is running because of an interrupt from Teletype, and 2's if the PP is running because its controllee suspended waiting for a message from controller)."

Keith A. Dawson, Ext. 7679
TID Computer Documentation Group

LIVERMORE TIME-SHARING SYSTEM

Part 1: Octopus
Chapter 9: CDC 6600 System Calls and
I/O Requests

Marilyn D. Richards
Harriet Coverston
Pierre Du Bois
Paul. E. Lund
Nancy A. Storch
Clark L. Streeter

Edition 3: May 27, 1969
Change 4: January 29, 1974

CHANGE RECORD

<u>Change</u>	<u>Pages Affected:</u>
May 27, 1969 Edition 3	—
"Errata 1" Sept. 23, 1969	13.
"Errata 1" Dec. 3, 1969	12, 18, 19a, 21, 51, 52.
"Errata 1" March 9, 1970	19, 28a.
"Errata 2" March 9, 1970	27, 28.
"Errata 1" Oct. 1, 1970	1, 4, 22, 29, 35-37, 41, 42, 45.
"Errata 2" Oct. 1, 1970	20.
Change 1 Jan. 21, 1971	Front cover, 3, 5, 6, 16, 17, 20a, 23, 24, 30a-30f, 38, 49, 53.
Change 2 Sept. 15, 1972	Front cover, title, 1a, 1b, 3, 3a, 4-6, 6a, 9, 11, 13, 16, 17, 21, 23, 27, 27a, 28, 28a, 28b, 29, 30d, 30e, 31, 34-38, 40, 42, 43, 49.
"Errata 1" Oct. 20, 1972	1b, 3b, 6, 24
Change 3 Dec. 14, 1973	Front cover, title, 1a, 3, 4, 6a, 8, 9, 13, 14, 14a, 14b, 53, 54, 55, 56, 57
Change 4 Jan. 24, 1974	Front cover, title, 1a, 1b, 4a, 4b, 6, 6a, 9, 13, 24, 26, 54, 55

REPLACEMENT NOTICE

This document supersedes all previous editions of LTSS-9. In addition it incorporates the changes in "Errata 1," October 20, 1972, and ■
supersedes the following Octopus Communiques:

- No. 311, September 30, 1970 ■
- No. 338, April 5, 1971
- No. 340, April 28, 1971
- No. 343, May 10, 1971
- No. 359, June 17, 1971
- No. 378, August 6, 1971

NOTATION: IT IS FREQUENTLY NECESSARY TO SET WORDS AND PHRASES OFF FROM THE BODY OF THE TEXT. UNFORTUNATELY, SINCE THE ENTIRE TEXT IS WRITTEN IN CAPITAL LETTERS, WE ARE UNABLE TO USE CASE AS A DISTINGUISHING CHARACTERISTIC. THEREFORE, VARIOUS PUNCTUATION MARKS ARE USED.

- A. LANGUAGE STATEMENTS AND MESSAGE STRINGS ARE SEPARATED FROM TEXT BY QUOTATION MARKS. FOR EXAMPLE: THE SYSTEM SENDS A MESSAGE 'PROBLEM ERROR 0200' TO THE TELETYPE ...
- B. TO DEFINE A WORD OR PHRASE, THE TERM IS INCLUDED BETWEEN BRACKETS < >. FOR EXAMPLE: A <TELETYPE> IS A MACHINE ...
- C. VARIOUS LEVELS OF NAMES ARE INCLUDED IN THE FOLLOWING TABLE:

LEVEL	PUNCTUATION	EXAMPLES
-----	-----	-----
SYSTEM NAME	NONE	THE FROST SYSTEM...
FILE NAME	/.... /	PUBLIC FILE /LRLLIB/ IS...
PROGRAM NAME	-....-	SUBROUTINE -ALTER- WILL...
VARIABLE NAME	'....'	SET 'ABC' EQUAL TO

- D. IT IS ALSO FREQUENTLY NECESSARY TO INDICATE CONTENTS AND LOCATIONS. THIS IS DONE BY THE FOLLOWING:

	PUNCTUATION	EXAMPLES
	-----	-----
CONTENTS OF	[....]	[ABC] = 4.
LOCATION OF	(....)	(ABC) = 10472
		(LRLLIB) = DISC ADDRESSES 107-11231

THIS NOTATION ALLOWS US TO DISTINGUISH BETWEEN DIFFERENT ENTITIES THAT HAVE THE SAME NAMES. FOR EXAMPLE, 'PUBLIC FILE /OUT/ CONTAINS PROGRAM -OUT-'. PUNCTUATION IS OFTEN OMITTED IF THE TERM IS ON A LINE OF ITS OWN, IS IN A TABLE, OR IS IN A LIST.

CROSS REFERENCES:

- 1. CROSS REFERENCES WITHIN CHAPTER 9 ARE INDICATED BY CHAPTER.SECTION.SUBSECTION AND PAGE NUMBER: (SEE 9.7.1, PAGE 20).
- 2. CROSS REFERENCES TO OTHER CHAPTERS ARE INDICATED IN THE SAME WAY, BUT WITHOUT PAGE NUMBERS: (SEE 4.7.3 AND 5.8).

Contents

	Page
9.1. Formats for System Calls	4
9.2. Calls to FROST	6
9.2.1. Create	6
9.2.2. Destroy	7
9.2.3. Open	9
9.2.4. This Problem Program is Finished	10
9.2.5. Give Files to Other Users	11
9.2.6. Send a Message to the Operator	12
9.2.7. Get File Index or Active Users List	13
9.2.8. Give Tapes to Controllee	14a
9.2.9. File Name, Program Name, Account Number, -and- Donate Time	15
9.2.10. Give up File Space	16
9.2.11. Adjust Core Space	17
9.2.12. Send a Message to the Controller	18
9.2.13. Send a Message to the Controllee	20
9.2.14. Get a Message from the Controller	21
9.2.15. Get a Message from the Controllee	22
9.2.16. Get Symbols from the Controller	22
9.2.17. Get Symbols from the Controllee	24
9.2.18. Initialize or Disconnect a Controllee	25
9.2.19. Close	26
9.2.20. Time Limit, User Number, Bank Account, Priority, etc..	27
9.2.21. Automatic Suspend and Restart	29
9.2.22. Message Bypass Control	30
9.2.23. Send a Message to Device	30a
9.2.24. Get a Message from Device	30d
9.3. Calls to CMPPU	31
9.3.1. Request Time Clock	31
9.3.2. Give Up CPU - Next Turn	32
9.3.3. Give up CPU - I/O	32
9.3.4. Return from an Interrupt Routine	34
9.3.5. Set or Clear SCOPE Flag	34
9.4. Format for Input/Output Requests	35
9.4.1. Format of an IOD	36
9.4.2. Remarks	39
9.5. Input/Output Programs Available	41
9.5.1. Read Even-Parity (BCD) Tape	41
9.5.2. Display on DD80	41
9.5.3. Write Even-Parity (BCD) Tape	42
9.5.4. Skip Records	42
9.5.4(A). Display on G Machine Scopes	42
9.5.4(B). Read/Write Central Memory	42
9.5.5. Illegal	43
9.5.6. Read Odd-Parity (Binary) Tape	43
9.5.7. Write Odd-Parity (Binary) Tape	44
9.5.8. Disc Read	44
9.5.9. Disc Write	45
9.5.10. Read Tape Unit Status	46
9.5.11. Rewind	46

	Page
9.5.12. Rewind Unload	46
9.5.13. Write Filemark	47
9.5.14. Set Density to 200 BPI	47
9.5.15. Set Density to 556 BPI	47
9.5.16. Set Density to 800 BPI	47
9.6. Error Indications	48
9.6.1. Notes on the Operation of I/O Packages	48
9.6.2. Standard I/O Error Messages	48
9.6.3. Miscellaneous PP Error Messages	49
Appendix A. Minus Word Formats	51
Appendix B. Formats for Tables in Call 24NN (p. 27)	55

	Page
9.5.12. Rewind Unload	46
9.5.13. Write Filemark	47
9.5.14. Set Density to 200 BPI	47
9.5.15. Set Density to 556 BPI	47
9.5.16. Set Density to 800 BPI	47
9.6. Error Indications	48
9.6.1. Notes on the Operation of I/O Packages	48
9.6.2. Standard I/O Error Messages	48
9.6.3. Miscellaneous PP Error Messages	49
Appendix A. Minus Word Formats	51
Appendix B. Formats for Tables in Call 24NN (p. 27)	54

9.1. FORMATS FOR SYSTEM CALLS

FROST WILL EXAMINE AAAAAA, BBBBBB, RETURN+1, AND ANY OTHER ADDRESSES INVOLVED FOR OUT-OF-BOUNDS MEMORY REFERENCES. IF ANY ONE OF THEM IS OUT-OF-BOUNDS, IT IS TREATED AS A HARDWARE INTERRUPT.

THE FOLLOWING IS A LIST OF THE AVAILABLE CALLS TO FROST, WITH REFERENCES TO THE PAGES ON WHICH MORE DETAILED INFORMATION MAY BE FOUND.

CC	PAGE	NAME OF CALL
--	----	-----
01	6	CREATE.
02	7	DESTROY.
03	9	OPEN.
04	10	THIS PROBLEM PROGRAM IS FINISHED.
05	11	GIVE FILES TO OTHER USERS.
06	12	SEND A MESSAGE TO THE OPERATOR.
07	13	GET FILE INDEX LIST OR GET ACTIVE USERS LIST.
10	14	GIVE TAPES TO CONTROLLEE.
11	15	CHANGE FILE NAME -OR- DONATE TIME -OR- CHANGE ACCOUNT NUMBER -OR- CHANGE PROBLEM PROGRAM NAME.
12	16	GIVE UP FILE SPACE.
13	17	ADJUST CORE SPACE -OR- LOAD AT LOW ADDRESS.
14	18	SEND A MESSAGE TO THE CONTROLLER.
15	19	SEND A MESSAGE TO THE CONTROLLEE.
16	21	GET A MESSAGE FROM THE CONTROLLER.
17	22	GET A MESSAGE FROM THE CONTROLLEE.
20	22	GET SYMBOLS FROM THE CONTROLLER.
21	24	GET SYMBOLS FROM THE CONTROLLEE.
22	25	INITIALIZE OR DISCONNECT A CONTROLLEE.
23	26	CLOSE.
24	27	MODIFY TIME LIMIT OR PRIORITY -OR- GET USER NUMBER AND BANK ACCOUNT -OR- GET TIME LIMIT AND PRIORITY -OR- GET PERCENTAGE TIME CHARGED -OR- GET PROBLEM PROGRAM NAME AND FIELD LENGTH -OR- GET DESCRIPTOR BLOCK AND USER BLOCK TABLES.
25	29	AUTOMATIC SUSPEND AND RESTART.
26	30	INPUT/OUTPUT BYPASS CONTROL.
31	30a	Send a message to device.
32	30d	Get a message from device.

THE FOLLOWING IS A LIST OF THE AVAILABLE CALLS TO CMPPU, WITH REFERENCES TO THE PAGES ON WHICH MORE DETAILED INFORMATION MAY BE FOUND.

TTTT	PAGE	NAME OF CALL
----	----	-----
UU01	31	REQUEST TIME CLOCK.
0002	32	GIVE UP CPU -- NEXT TURN.
CC10	32	GIVE UP CPU -- INPUT/OUTPUT.
0020	34	RETURN FROM AN INTERRUPT ROUTINE.

9.1. FORMATS FOR SYSTEM CALLS

Page 3b

A system call is a request by a problem program for certain functions to be performed. With the exception of the "THIS PP IS FINISHED" call, there are no restrictions on the frequency or volume of system calls.

The method of issuing a system call is as follows:

1. A halt instruction (00) is placed in the first thirty bits of a word (relative word zero).
2. Information about the nature of the request is stored in the last thirty bits of relative word zero.
3. The problem program executes a transfer to location zero.
4. IMPPU will frequently read the CPU program counter. When the program counter is a zero, IMPPU will read relative word zero and take appropriate action.

All registers are preserved for any system call. This statement remains true regardless of the number of calls in queue for a given problem program.

In all cases, the last thirty bits of relative word zero have the (octal) format

TTTTA AAAAA

where

TTTT indicates the type of call. If TTTT = 1004, the call is processed by FROST. Otherwise, the call is processed by CMPPU.

AAAAAA is usually the address of another word, ALPHA, which further defines the specific system service desired.

In case of a call to FROST (TTTT = 1004), word ALPHA has the (octal) format:

CCNNR ETURN XXXXB BBBBB

where:

CC is the code number that determines the type of call.

NN is certain information required for the call.

RETURN is an address. If this system call has not successfully completed, control will be sent to RETURN. If the call is successfully completed, control will be sent to RETURN+1.

XXXX is certain information required for the call.

BBBBBB is usually the address of a second word, BETA, that contains additional information required for the call. The format of the beta word(s) is discussed with each individual call.

In case of a call to CMPPU (TTTT is not 1004), the meaning of AAAAAA is discussed with each individual call.

In addition to the (priority weighted) charge for CPU time used, each problem program is charged for system calls as follows:

1. No charge for calls beneficial to the system (this includes all calls to CMPPU).
2. Two milliseconds for any call not beneficial to the system.
3. 64 milliseconds +(4 microseconds X problem program field length) for each load and dump of problem program, provided these loads and dumps were not system initiated due to priority dumps.

9.1. FORMATS FOR SYSTEM CALLS

A system call is a request by a problem program for certain functions to be performed. With the exception of the "THIS PP IS FINISHED" call, there are no restrictions on the frequency or volume of system calls.

The method of issuing a system call is as follows:

1. A halt instruction (00) is placed in the first thirty bits of a word (relative word zero).
2. Information about the nature of the request is stored in the last thirty bits of relative word zero.
3. The problem program executes a transfer to location zero.
4. IMPPU will frequently read the CPU program counter. When the program counter is a zero, IMPPU will read relative word zero and take appropriate action.

All registers are preserved for any system call. This statement remains true regardless of the number of calls in queue for a given problem program.

In all cases, the last thirty bits of relative word zero have the (octal) format

TTTTA AAAAA

where

TTTT indicates the type of call. If TTTT = 1004, the call is processed by FROST. Otherwise, the call is processed by CMPPU.

AAAAAA is usually the address of another word, ALPHA, which further defines the specific system service desired.

In case of a call to FROST (TTTT = 1004), word ALPHA has the (octal) format:

CCNNR ETURN XXXXB BBBB

where:

CC is the code number that determines the type of call.

NN is certain information required for the call.

RETURN is an address. If this system call has not successfully completed, control will be sent to RETURN. If the call is successfully completed, control will be sent to RETURN+1.

XXXX is certain information required for the call.

BBBBBB is usually the address of a second word, BETA, that contains additional information required for the call. The format of the beta word(s) is discussed with each individual call.

In case of a call to CMPPU (TTTT is not 1004), the meaning of AAAAAA is discussed with each individual call.

In addition to the (priority weighted) charge for CPU time used, each problem program is charged for system calls as follows:

1. No charge for calls beneficial to the system (this includes all calls to CMPPU).
2. Two milliseconds for any call not beneficial to the system.
3. 64 milliseconds +(4 microseconds $\times$ problem program field length) for each load and dump of problem program, provided these loads and dumps were not system initiated due to priority dumps.

9.1. FORMATS FOR SYSTEM CALLS

FROST WILL EXAMINE AAAAAA, BBBBBB, RETURN+1, AND ANY OTHER ADDRESSES INVOLVED FOR OUT-OF-BOUNDS MEMORY REFERENCES. IF ANY ONE OF THEM IS OUT-OF-BOUNDS, IT IS TREATED AS A HARDWARE INTERRUPT.

THE FOLLOWING IS A LIST OF THE AVAILABLE CALLS TO FROST, WITH REFERENCES TO THE PAGES ON WHICH MORE DETAILED INFORMATION MAY BE FOUND.

CC	PAGE	NAME OF CALL
--	----	-----
01	6	CREATE.
02	7	DESTROY.
03	9	OPEN.
04	10	THIS PROBLEM PROGRAM IS FINISHED.
05	11	GIVE FILES TO OTHER USERS.
06	12	SEND A MESSAGE TO THE OPERATOR.
07	13	GET FILE INDEX LIST OR GET ACTIVE USERS LIST.
10	14	GIVE TAPES TO CONTROLLEE.
11	15	CHANGE FILE NAME -OR- DONATE TIME -OR- CHANGE ACCOUNT NUMBER -OR- CHANGE PROGRAM NAME.
12	16	GIVE UP FILE SPACE.
13	17	ADJUST CORE SPACE -OR- LOAD AT LOW ADDRESS.
14	18	SEND A MESSAGE TO THE CONTROLLER.
15	19	SEND A MESSAGE TO THE CONTROLLEE.
16	21	GET A MESSAGE FROM THE CONTROLLER.
17	22	GET A MESSAGE FROM THE CONTROLLEE.
20	22	GET SYMBOLS FROM THE CONTROLLER.
21	24	GET SYMBOLS FROM THE CONTROLLEE.
22	25	INITIALIZE OR DISCONNECT A CONTROLLEE.
23	26	CLOSE.
24	27	MODIFY TIME LIMIT OR PRIORITY -OR- GET USER NUMBER AND BANK ACCOUNT -OR- GET TIME LIMIT AND PRIORITY -OR- GET PERCENTAGE TIME CHARGED -OR- GET PROGRAM NAME AND FIELD LENGTH -OR- GET DESCRIPTOR BLOCK AND USER BLOCK TABLES.
25	29	AUTOMATIC SUSPEND AND RESTART.
26	30	INPUT/OUTPUT BYPASS CONTROL.
31	30a	Send a message to device.
32	30d	Get a message from device.

THE FOLLOWING IS A LIST OF THE AVAILABLE CALLS TO CMPPU, WITH REFERENCES TO THE PAGES ON WHICH MORE DETAILED INFORMATION MAY BE FOUND.

TTTT	PAGE	NAME OF CALL
----	----	-----
UU01	31	REQUEST TIME CLOCK.
0002	32	GIVE UP CPU -- NEXT TURN.
CC10	32	GIVE UP CPU -- INPUT/OUTPUT.
0020	34	RETURN FROM AN INTERRUPT ROUTINE.

Change 2: Sept. 15, 1972

Page 5

0021	34	Allow interception of SCOPE (a CDC operating
0022		system) system calls for modification to FROST
		system calls.
		21 = clear SCOPE flag.
		22 = set SCOPE flag.

9.2. CALLS TO FROST

9.2.1. Create

This call reserves space on disc for a hitherto nonexistent file or set of files, and/or reserves an input/output unit or group of units (not disc) for use by this problem program in addition to reserving the requested items, this call makes it possible for the requesting problem program to communicate with them.

Format:

Word O: 00000 00000 1004A AAAA

where:

AAAAAA is the address of word ALPHA

Word ALPHA: 01NNR ETURN 00DDB BBBB

where:

01 is the code for 'create'.

NN is the number of files and/or devices.

RETURN is an address. If this system call was not successfully completed, control will be sent to 'return'. If the call is successfully completed, control will be sent to 'return+1'.

DD indicates which option is desired.

DD=00 for a normal create.

DD=01 for the drop-file request (destroy duplicate file option).

DD=02 for the drop-file request (do not destroy duplicate file option).

BBBBBB is the address of the first word, BETA, of the NN (less than seventeen) requests.

Word BETA: Name of disc file, or tape vault number (ASCII, right justified). For disc files, the name may be up to ten characters long; for tape vault numbers, up to six characters; for G machine online scopes, one ASCII character = J, K, L, or M.
(DD=00)

Word BETA: The name of the drop file. If there is already a file by this name, FROST will destroy it (if DD=01) or transfer control to the error return (if DD=02). If BETA=00, FROST will generate a recognizable and unique ASCII name.
(DD=01, 02)

■ Word BETA+1: MMSST TUUXX LLWWW WWWWW
(DD=00)

where:

MM is the minus word designation for this file.

SS is filled in (by FROST) on completion of the system call, as follows:

SS=00 normal completion.

SS=01 name duplication or name not in file index. For TT = 05 or 45g, pack is not there.

SS=02 not enough space.

SS=03 access denied (SCOPE not available if TT=03). For TT = 45g, pack is locked out.

SS=04 format or parameter error.

SS=05 operator initiated tape error (tape not in vault).
 SS=07 file index or disc trouble.
 SS=10 LL was greater than 7 or LL was not a legal machine level.
 SS=12 (DD=02) file already exists.
 SS=13 (DD=01) FROST cannot destroy the existing file.

TT is type of unit:

TT=00 disc.
 TT=01 half-inch tape.
 TT=02 one-inch tape.
 TT=03 G machine devices (G machine only).
 TT=05 disk pack, multiple access (restricted use).
 TT=45 disk pack, single access (restricted access).
 TT=11 dd80 (L-machine only).

UU If TT=00, then UU is disc specification, if desired (01, 02, or 03), on which this file is to be created. FROST will fill in, upon completion and only if it was originally non-zero, the disc (1 through 3) on which it was actually created. If it was zero when the call was made, the file will be created on a round robin basis on the next Disc where space is available, and FROST will leave UU=0. If the file cannot be created on the disc requested due to lack of space or due to the disc being "locked out", the file will be created on the next available disc.

If TT=01, then UU is the tape unit number assigned by the machine operator.

LL is the access level (a number 0-7). If LL=0 the file will be created at the operating level of the creator.

XX specifies file type. If XX=05 file is execute-only drop file (DD=01, 02).

WW... W is the word length for this file. WW... W is examined if and only if TT=00 (i.e., disc). For TT=05 or 45, the physical pack number will be returned by FROST.

Word BETA+1: The length at which the drop file is to be created (at least (DD=01, 02) 401g). If BETA+1 is zero, FROST will generate a length sufficient to contain the calling program.

9.2. CALLS TO FRST

WORD BETA+2: SAME AS BETA
BETA+3: SAME AS BETA+1
..
..
..
BETA+30: SAME AS BETA
BETA+31: SAME AS BETA+1

FOR SS > 00, CONTROL WILL GO TO 'RETURN'; MINUS WORDS MAY NOT BE SET.
FOR SS = 00, CONTROL WILL GO TO 'RETURN+1'; MINUS WORDS WILL BE SET.

FOR TT = 01 AND TT = 02, THE SIX-CHARACTER TAPE VAULT NUMBER WILL BE TYPED ON THE OPERATOR'S TELETYPE. THE OPERATOR WILL LOCATE THE REQUESTED TAPE AND MAKE IT AVAILABLE TO THE SYSTEM.

CREATES ARE PROCESSED IN THE FOLLOWING ORDER, REGARDLESS OF THE ORDER IN WHICH THEY ARE ISSUED:

1. TAPES.
2. OTHER NON-DISC EQUIPMENT.
3. DISC FILES.

AN ERROR RETURN WILL BE GIVEN IF THE LENGTH OF THE FILE IS A NEGATIVE NUMBER.

CHARGE: 2 MILLISECONDS.

9.2.2. DESTROY

THIS CALL ALLOWS THE PROBLEM PROGRAM TO GIVE UP DISC FILES AND/OR RELEASE INPUT/OUTPUT DEVICES (OTHER THAN TELETYPE). IN THE CASE OF GIVING UP DISC SPACE, THE DISC SPACE PRESENTLY BEING OCCUPIED BY THE SPECIFIED FILE OR SET OF FILES IS GIVEN BACK TO THE SYSTEM FOR REASSIGNMENT *(1)*. IN ADDITION TO RELEASING THE SPECIFIED ITEMS, THIS CALL MAKES IT IMPOSSIBLE FOR THE REQUESTING PROBLEM PROGRAM TO COMMUNICATE WITH THEM.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

(1) COMPARE 'CLOSE', PAGE 26.

9.2. CALLS TO FRST

WORD ALPHA: 02NNR ETURN 0000B BBBB

WHERE:

02 IS THE CODE FOR 'DESTROY'.
 NN IS THE NUMBER OF DESTROY REQUESTS.
 RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.
 BBBB IS THE ADDRESS OF THE FIRST WORD, BETA, OF THE NN (LESS THAN SEVENTEEN) REQUESTS.

WORD BETA: NAME OF DISC FILE, OR TAPE VAULT NUMBER (ASCII, RIGHT JUSTIFIED).

WORD BETA+1: MMSST TUU00 000000000000.

WHERE:

MM IS THE MINUS WORD FOR THIS FILE.
 SS IS FILLED IN (BY FRST) ON COMPLETION OF THE SYSTEM CALL, AS FOLLOWS:
 SS-00 NORMAL COMPLETION.
 SS-01 NAME NOT IN FILE INDEX.
 SS-03 DESTROY NOT ACCOMPLISHED (WRONG MINUS WORD OR NAME).
 SS-04 FORMAT OR PARAMETER ERROR.
 SS-05 ANOTHER CURRENTLY EXECUTING PROBLEM PROGRAM HAS THIS FILE OPEN.
 SS-06 TAPE DESTROY ERROR (WRONG NAME OR VOID).
 SS-07 DISC MAP TROUBLE. FILE NOT DESTROYED.
 TT IS TYPE OF FILE:
 TT-00 DISC.
 TT-01 HALF-INCH TAPE.
 TT-02 ONE-INCH TAPE.
 TT-11 dd80 (L-MACHINE ONLY).

UU=1 delete file from file index (User-1 only).

WORD BETA+2: SAME AS BETA

BETA+3: SAME AS BETA+1

..
 ..
 ..

FOR SS > 00, CONTROL WILL GO TO 'RETURN'; MINUS WORDS MAY NOT BE SET.

FOR SS = 00, CONTROL WILL GO TO 'RETURN+1'; MINUS WORDS WILL BE SET.

FRST WILL IGNORE A DESTROY REQUEST UNLESS THE FILE BEING DESTROYED WAS CREATED OR OPENED BY THE PROBLEM PROGRAM DURING THE CURRENT PROBLEM PROGRAM EXECUTION TIME, OR IF THE FILE BE PUBLIC. IF THE DESTROY REQUEST IS CARRIED OUT MINUS WORDS WILL BE ERASED.

CHARGE: NONE.

9.2. CALLS TO FROST

9.2.3. OPEN

THIS CALL MAKES IT POSSIBLE FOR THE REQUESTING PROGRAM PROGRAM TO COMMUNICATE WITH A DISC FILE OR SET OF DISC FILES WHICH HAVE BEEN PREVIOUSLY CREATED BY THE USER OR ARE PUBLIC FILES *(2)*.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 03NNR ETURN 0000B BBBB

WHERE:

03 IS THE CODE FOR 'OPEN'.

NN IS THE NUMBER OF FILES REQUESTED.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB IS THE ADDRESS OF THE FIRST WORD, BETA, OF THE NN (LESS THAN SEVENTEEN) REQUESTS.

WORD BETA: NAME OF DISC FILE (ASCII, RIGHT JUSTIFIED).

WORD BETA+1: MMSSP OUURR TLZZZ ZZZZZ

WHERE:

MM IS THE MINUS WORD DESIGNATION FOR THIS FILE.

SS IS FILLED IN (BY FROST) ON COMPLETION OF THE SYSTEM CALL, AS FOLLOWS:

SS=00 NORMAL COMPLETION.

SS=01 NAME DUPLICATION OR NAME NOT IN FILE INDEX.

SS=02 READ ONLY.

SS=03 ACCESS DENIED.

SS=10 Tried to open an execute only file.

P IS THE FILE TYPE. IF THE FILE OPENED IS PUBLIC, FROST WILL FILL IN P-1. If the file opened is divisional, FROST will fill in P-2. IF IT IS PRIVATE, NO ACTION IS TAKEN BY FROST.

UU IS FILLED IN (BY FROST) WITH THE NUMBER OF THE DISC UNIT (0,1,2) ON WHICH THE FILE RESIDES.

RR is the read/write status of the file.

RR=01 for open file and set type to read/write.

RR=02 for open file and set type to read-only.

T is file type, filled in by FROST.

T=2 means the file is read-only.

If the file is read/write FROST does not set T.

L is filled in by FROST with the access (classification) level of the file.

ZZ...Z will be filled in (by FROST) with the number of words in the opened file.

9.2. CALLS TO FROST

WORD BETA+2: SAME AS BETA
 BETA+3: SAME AS BETA+1

..
 ..
 ..

FOR SS = 01 AND SS = 03, CONTROL WILL GO TO 'RETURN'; MINUS WORDS MAY NOT BE SET.
 FOR SS = 00 AND SS = 02, CONTROL WILL GO TO 'RETURN+1'; MINUS WORDS WILL BE SET.

CHARGE: 2 MILLISECONDS.

9.2.4. THIS PROBLEM PROGRAM IS FINISHED

 THIS CALL INDICATES THAT THIS PROBLEM PROGRAM HAS RUN TO ITS NORMAL TERMINATION POINT. THE REQUESTING PROBLEM PROGRAM WILL NOT RECEIVE ANY MORE COMPUTER TIME. AS SOON AS ALL MESSAGES ORIGINATED BY IT HAVE BEEN DELIVERED TO ITS CONTROLLER, THE PROBLEM PROGRAM WILL BE DISCONNECTED FROM THE SYSTEM.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 04DDR ESUME 00000 00000

WHERE:

04 IS THE CODE FOR 'THIS PROBLEM PROGRAM IS FINISHED'.

DD INDICATES WHETHER THE PROBLEM PROGRAM IS TO BE SAVED.

DD-00 MEANS ERASE PROBLEM PROGRAM FROM CORE BUT PRESERVE ITS FINAL STATE IN ITS DISC FILE.

DD-01 MEANS ERASE PROBLEM PROGRAM FROM CORE AND DISC.

RESUME IS THE ADDRESS AT WHICH THE PP WILL START IF IT IS TO BE USED AGAIN (THIS FEATURE MAY BE USED TO AUTOMATICALLY INITIALIZE A SERVICE PROGRAM).

THIS REQUESTING PROBLEM PROGRAM IS REMOVED FROM CENTRAL MEMORY AND STORED UNDER ITS EXECUTING NAME IN THE USER FILE INDEX. THE LAST MESSAGE PREVIOUSLY SENT BY THE PROBLEM PROGRAM IS TRANSMITTED TO THE CONTROLLER (USER) WHEN THE CONTROLLER (USER) LOGS IN. WHEN THE MESSAGE TRANSMISSION TERMINATES, 'ALL DONE' WILL BE TRANSMITTED AND THE DONE SEQUENCE WILL BE INITIATED. CONTROL WILL NOT BE RETURNED TO THE PROBLEM PROGRAM.

CHARGE: 2 MILLISECONDS.

9.2. CALLS TO FROST

9.2.5. GIVE FILES TO OTHER USERS

THIS CALL MAKES IT POSSIBLE FOR ONE USER TO GIVE DATA OR PROGRAMS TO ANOTHER USER.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 05NNR ETURN 0000B BBBB

WHERE:

05 IS THE CODE FOR 'GIVE FILES TO OTHER USERS'.

NN IS THE NUMBER OF FILES GIVEN.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB IS THE ADDRESS OF THE FIRST WORD, BETA, OF THE NN (LESS THAN SEVENTEEN) REQUESTS.

WORD BETA: NAME OF DISC FILE (ASCII, RIGHT JUSTIFIED).

WORD BETA+1: 00SSO OXXXX XXXXX XXXXX

WHERE:

SS IS FILLED (BY FROST) ON COMPLETION OF THE SYSTEM CALL AS FOLLOWS:

SS=00 NORMAL.

SS=01 A FILE BY THIS NAME IS ALREADY THERE.

SS=02 PUBLIC FILE NAME (CANNOT GIVE A FILE WHOSE NAME IS THE SAME AS A PUBLIC FILE).

SS=03 THERE IS NO FILE BY THIS NAME TO GIVE.

SS=04 INCORRECT FORMAT FOR USER NUMBER XX...X.

SS=05 ANOTHER CURRENTLY EXECUTING PROBLEM PROGRAM HAS THIS FILE OPEN.

SS=06 file is currently being written or read by the file-transport system.

SS=10 attempting illegal give of a classified file.

XX...X IS THE (ASCII) USER NUMBER TO WHICH THE FILE IS TO BE GIVEN.

WORD BETA+2: SAME AS BETA

BETA+3: SAME AS BETA+1

.. .
.. .
.. .

FOR SS > 00, CONTROL WILL GO TO 'RETURN'; FOR SS = 00, CONTROL WILL GO TO 'RETURN+1'.

FROST WILL CLEAR THE MINUS WORD ASSOCIATED WITH A DISC FILE GIVEN TO ANOTHER USER.

9.2. CALLS TO FROST

CHARGE: 2 MILLISECONDS.

9.2.6. SEND A MESSAGE TO THE OPERATOR

BY MEANS OF THIS CALL, BRIEF MESSAGES MAY BE SENT TO THE OPERATOR, GIVING DIRECTIONS, ADDITIONAL INFORMATION, OR OPINIONS.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 0600R ETURN 00MMB BBBBB

WHERE:

06 IS THE CODE FOR 'SEND A MESSAGE TO THE OPERATOR'.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

MM IS THE NUMBER OF MAIN FRAME WORDS CONTAINING THE MESSAGE (MM MUST BE LESS THAN NINE). THE ERROR RETURN IS TAKEN IF MM IS LESS THAN OR EQUAL TO 00 OR IS GREATER THAN 08.

BBBBBB IS THE ADDRESS OF THE FIRST WORD, BETA, OF THE MM WORDS CONTAINING THE MESSAGE.

WORD BETA: ...MESSAGE...

BETA+1: ...MESSAGE...

.. .
.. .
.. .

THE MESSAGE STRING MUST ***NOT*** CONTAIN AN END-OF-MESSAGE STRING (400204).

CHARGE: 2 MILLISECONDS.

9.2. CALLS TO FROST

9.2.7. GET FILE INDEX OR ACTIVE USERS LIST

THIS CALL ALLOWS A USER TO GET A COPY OF HIS PERSONAL FILE INDEX OR THE PUBLIC FILE INDEX, OR TO GET A LIST OF CURRENTLY ACTIVE USER NUMBERS AND THE CURRENT VALUE OF THEIR BANK ACCOUNTS.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 07NNR ETURN MMMMB BBBB

WHERE:

07 IS THE CODE FOR 'GET FILE INDEX LIST'.

NN INDICATES WHETHER THE PUBLIC FILE INDEX, OR PRIVATE FILE INDEX, OR THE LIST OF CURRENTLY ACTIVE USER NUMBERS IS DESIRED.

NN=0 means get public file index (does not include divisional files), 2 words per file entry.

NN=01 means get private file index, 2 words per file entry.

NN=02 means get public and divisional index, 3 words per file entry.

NN=03 means get currently active user numbers, 2 words per entry.

NN=06 means get list of files in security pool.

NN=10 list current User-1 tape numbers.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

MMM IS THE MAXIMUM NUMBER OF FILES OR USER NUMBERS. BUFFER LENGTH MUST BE AT LEAST 2*MMM.

BBBBB IS THE ADDRESS OF THE FIRST WORD, BETA, OF THE BUFFER.

Word BETA: N = 0 or 1 or 2: Name of disc file (will be ASCII, right justified).

N = 3: USER NUMBER (WILL BE ASCII, RIGHT JUSTIFIED).

Word BETA+1 N = 0 or 1 or 2: LLXCD DDDDD DDZZZ ZZZZZ (supplied by the system)

Where:

LL specifies the protection status of the file.

LL=01 means the file is read/write.

LL=41 means the file is read only.

LL=21 means file is being destroyed.

X is access information level (0-7).

C is channel. If on disk, C=0, 1, or 2. If on pack, C=4.

DD...D IS THE TIME LAST REFERENCED (MICROSECOND CLOCK SHIFTED RIGHT 24 BITS).

ZZ...Z IS THE NUMBER OF WORDS IN THE FILE.

N = 3: USER BANK ACCOUNT (INTEGER MICROSECONDS).

Word BETA+2 N=2 only: DDAU0 000000 000000 000000

where:

DD is the division number if divisional file.
DD=00 if public file.

A is file access.

A=0 Global access.

A=1 Restricted divisional access.

U If channel (C) equals 4, U is the logical pack unit (0-7) on which the file resides.

Word BETA N=10 DDDDD DDDDD EEEEE EEEEE

D FR80 tape identification number is returned by FROST.

E FRAD tape identification number is returned by FROST.

Word BETA+1 N=10 FFFFF FFFFFF GGGGG GGGGG

F CRT tape identification number is returned by FROST.

G HSP tape identification number is returned by FROST.

Word BETA+2 N=10 00000 00000 HHHHH HHHHH

H DD80 tape identification number is returned by FROST.

9.2. CALLS TO FHOST

For N=0, 1, or 3:

Word BETA+2:	Same as BETA
BETA+3:	Same as BETA+1
..	.
..	.
..	.

For N=2:

Word BETA+3	Same as BETA.
Word BETA+4	Same as BETA+1.
Word BETA+5	Same as BETA+2.
..	.
..	.
..	.

CHARGE: 2 MILLISECONDS.

Remarks: There are two types of divisional files, global access and restricted access.

In global access, all users may access this divisional file, but only the users belonging to the owner division may change the status of this file.

In restricted access, only the users belonging to the owner division may access this divisional file. Also, only the users belonging to the owner division may change the status of the file.

9.2.8. GIVE TAPES TO CONTROLLEE

THIS CALL GIVES A CONTROLLEE ACCESS TO A TAPE CREATED BY ITS CONTROLLER.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 10NNR ETURN 0000B BBBB

WHERE:

10 IS THE CODE FOR 'GIVE TAPES TO CONTROLLEE'.

NN IS THE NUMBER OF TAPES GIVEN.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB IS THE ADDRESS OF THE FIRST WORD, BETA, OF THE NN TAPE IDENTIFICATIONS.

WORD BETA: TAPE VAULT NUMBER (ASCII, RIGHT JUSTIFIED).

WORD BETA+1: MMSS0 00000 00000 00000

WHERE:

MM IS THE MINUS WORD FOR THIS TAPE.

SS IS FILLED IN (BY FROST) ON COMPLETION OF THE SYSTEM CALL, AS FOLLOWS:

SS-00 NORMAL COMPLETION.

SS-01 MEANS THE TAPE IS NOT DEFINED.

SS-02 MEANS WRONG MINUS WORD.

SS-03 MEANS THE CONTROLLEE ALREADY OWNS A PRIVATE TAPE IN THE MINUS WORD
THAT THE CONTROLLER IS TRYING TO USE TO GIVE THE TAPE.

9.2. CALLS TO FROST

WORD BETA+2: SAME AS BETA
 BETA+3: SAME AS BETA+1
 ..
 ..
 ..

FOR SS > 00, CONTROL WILL GO TO 'RETURN'; FOR SS = 00, CONTROL WILL GO TO 'RETURN+1'.

THE CONTROLLEE WILL GAIN ACCESS TO THE GIVEN TAPE IN THE SAME MINUS WORD NUMBER IN WHICH THE CONTROLLER OWNS THE TAPE. THE CONTROLLEE WILL NOT BE ALLOWED TO DESTROY THAT TAPE (AN SS=06 ERROR WILL BE RETURNED -- SEE PAGE 7). THE CONTROLLEE MAY CREATE A TAPE BY SOME OTHER NAME IN THE MINUS WORD IN WHICH THE PREVIOUS TAPE WAS GIVEN, WITH NO ILL EFFECTS ON THE CONTROLLER.

CHARGE: 2 MILLISECONDS.

9.2.9. FILE NAME, PROGRAM NAME, ACCOUNT NUMBER, -AND- DONATE TIME

THIS CALL ALLOWS ONE TO CHANGE THE NAME OF A FILE OR PROGRAM OR DONATE TIME TO ANOTHER USER OR TO CHANGE THE ACCOUNT NUMBER.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 11NNR ETURN 0000B BBBB

WHERE:

11 IS THE CODE FOR 'CHANGE FILE NAME'.

NN INDICATES WHICH OPTION IS DESIRED:

NN=00 CHANGE FILE NAME.

NN=01 CHANGE PROGRAM NAME.

NN=02 CHANGE ACCOUNT NUMBER.

NN=03 DONATE TIME.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL WAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBBB IS THE ADDRESS OF WORD BETA, CONTAINING ADDITIONAL INFORMATION REQUIRED BY THE CALL.

9.2. CALLS TO FROST

WORD BETA: NN = 00: OLD FILE NAME (ASCII, RIGHT JUSTIFIED).
 NN = 01: NEW PROGRAM NAME (ASCII, RIGHT JUSTIFIED).
 NN = 02: NEW ACCOUNT NUMBER (ASCII, RIGHT JUSTIFIED).
 NN = 03: DONOR USER NUMBER (ASCII, RIGHT JUSTIFIED).

WORD BETA+1: NN = 00: NEW FILE NAME (ASCII, RIGHT JUSTIFIED).
 NN = 01: NOT USED.
 NN = 02: OLD ACCOUNT NUMBER (ASCII, RIGHT-JUSTIFIED stored by FROST).
 NN = 03: DONEE USER NUMBER (ASCII, RIGHT JUSTIFIED).

WORD BETA+2: NN = 00: NOT USED.
 NN = 01: NOT USED.
 NN = 02: NOT USED.
 NN = 03: TIME TO BE DONATED (IN INTEGER MICROSECONDS).

AN ERROR RETURN INDICATES THAT THE FILE IS NOT THERE OR THAT THERE IS A NAME DUPLICATION.

CHARGE: 2 MILLISECONDS.

9.2.10. GIVE UP FILE SPACE

THIS CALL ALLOWS ONE TO SHRINK THE SIZE OF A DISC FILE.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 1200R ETURN 0000B BBBB

WHERE:

12 IS THE CODE FOR 'GIVE UP FILE SPACE'.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL WAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB IS THE ADDRESS OF A WORD, BETA, DEFINING THE FILE WHOSE LENGTH IS TO BE CHANGED.

WORD BETA: NAME OF FILE (ASCII, RIGHT JUSTIFIED).

9.2. CALLS TO FROST

WORD BETA+1: 00SS0 00000 00ZZZ ZZZZZ

WHERE:

SS IS FILLED IN (BY FROST) ON COMPLETION OF THE SYSTEM CALL, AS FOLLOWS:
SS=00 NORMAL COMPLETION.
SS=01 THE NEW FILE LENGTH IS LARGER THAN THE OLD FILE LENGTH.
SS=02 NAME NOT IN FILE INDEX.
ZZ...Z IS THE (USER SUPPLIED) LENGTH OF THE NEW FILE, ROUNDED UP TO THE NEAREST 100 (5CTAL).

IF SS = 00, CONTROL WILL GO TO 'RETURN+1'. IF SS > 00, CONTROL WILL GO TO 'RETURN'.

Charge=2 milliseconds.

Note: If the file is a classified file at a level higher than P=2, the user's minus word will be changed to indicate a shorter length, but disk-file space is not released in the system's file index. The minus word will contain the shorter length until the controllee is dumped to disk; on subsequent reloads the minus word will contain the old, longer length.

9.2.11. ADJUST CORE SPACE

IF, DURING THE COURSE OF AN EXECUTION, A PROBLEM PROGRAM REACHES A POINT WHEREIN IT NO LONGER NEEDS ALL OF THE CORE SPACE INITIALLY ALLOTTED TO IT, THE PROBLEM PROGRAM MAY SHRINK ITS OWN MEMORY BY DELETING THE UNUSED PORTION AT THE HIGH ADDRESS END. THIS CALL MAY ALSO BE USED TO INCREASE CORE STORAGE REQUIREMENTS.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 13NNR ETURN 0000B BBBB

WHERE:

13 IS THE CODE FOR 'ADJUST CORE SPACE'.

NN INDICATES THE OPTION DESIRED.

NN=00 MEANS ADJUST CORE SPACE.

NN=10 MEANS LOAD THIS PROBLEM PROGRAM STARTING AT THE high order ADDRESS.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL WAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB (NN=00) IS THE ADDRESS OF WORD BETA, WHICH CONTAINS THE (INTEGER) SIZE OF THE PROGRAM.

6600 SYSTEM CALLS AND I/O REQUESTS CIC-LTSS-9-ED.3 5/27/69 PAGE 18

9.2. CALLS TO FROST

CODE SPACE MAY BE ADJUSTED EITHER UP OR DOWN, LIMITED BY THE SIZE OF THE FILE (THAT IS, THE CODE LENGTH MUST BE AT LEAST 400 (OCTAL) LESS THAN ITS DISC FILE SIZE).

CHARGE: 2 MILLISECONDS TO INCREASE FIELD LENGTH.
 NO CHARGE TO DECREASE FIELD LENGTH.

9.2.12. SEND A MESSAGE TO THE CONTROLLER

THIS CALL MAY BE USED BY A PROBLEM PROGRAM TO SEND A MESSAGE TO ITS CONTROLLER. TO FACILITATE CONTROL BETWEEN A CONTROLLEE AND ITS CONTROLLER, THE ACT OF SENDING A MESSAGE TO A CONTROLLER ALSO SUSPENDS THE CONTROLLEE AND ACTIVATES THE CONTROLLER, UNLESS THE CONTROLLER IS A TELETYPE.

FORMAT:

WORD 0: 00000 00000 1004 AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 14NNR ETJRN 00MMB BBBB

WHERE:

14 IS THE CODE FOR 'SEND A MESSAGE TO THE CONTROLLER'.

NN DETERMINES THE OPTION TO BE TAKEN:

NN=00 SPECIFIES THE 'REPLACE' OPTION DESCRIBED BELOW.

NN=01 SPECIFIES THE 'NOTIFY' OPTION DESCRIBED BELOW.

NN=10 Specifies the "Direct to Teletype and Notify" option described below.

NN=12 Specifies the "Direct to Teletype and Replace" option described below.

Return is an address. If this system call has not successfully completed, control will be sent to 'return'. If the call is successfully completed, control will be sent to 'return+1'.

MM is the number of main-frame words in the message (MM must never be greater than fifteen).

BBBBBB is the address of word beta, the beginning of the message storage area.

9.2. CALLS TO FROST

WORD BETA: -----MESSAGE-----
BETA+1: -----MESSAGE-----
.
.
BETA+14: -----MESSAGE-----

The message starting in beta may be up to 150 characters long. Transmission is terminated by the end-of-message character (EOM), 400204, or 150 characters, whichever occurs first. If an end-of-message is omitted, FROST will insert one at the end of the message.

If the message is maximum length (currently 15, sixty-bit words) the FROST will insert the E.O.M. sentinel in the low order 18 bits of the 15th word.

If the message is less than maximum length, FROST will add another word containing the E.O.M. sentinel in the high order 18 bits.

Sending a message causes the system to copy the message from problem program core into a system buffer. Sending a message also starts the controller.

There are three possible paths of communication between the controllee (requesting program) and the controller (destination of message.)

- Path 1 - There are no problem program controllers between the controllee and the teletype.
- Path 2 - There is at least one problem program, whose output by-pass is not set, between the controllee and the teletype.
- Path 3 - All problem program controllers between the controllee and the teletype have their output by-passes set.

Buffer definition:

1. Length of buffer is fifteen (15) words.
2. Only one buffer available per suffix for teletype messages -- owned by the problem program closest to the teletype.
3. Each problem program has only one buffer used for both input and output to either teletypes, controllers, controllees.

Charge: 2 milliseconds if the message can be sent immediately

OPTION	PATH 1	PATH 2	PATH 3
NN = 01 NOTIFY	LOG OUT: Error return LOG IN: If buffer full, error return.	LOG OUT Error return LOG IN: If buffer full, error return	LOG OUT: Error return LOG IN: If buffer full, error return.
NN = 10 NOTIFY AND DIRECT TO TELETYPE	LOG OUT: Error return LOG IN: If buffer full, error return.	LOG OUT: Error return LOG IN: If buffer full, error return.	LOG OUT: Error return LOG IN: If buffer full, error return.
NN = 00 REPLACE	LOG OUT: Always replace message. LOG IN: If buffer full, dump to disc State = 14, until buffer empty.	LOG OUT: Always replace message LOG IN: If buffer full, dump to disc State = 14 until buffer empty.	LOG OUT: Always replace message LOG IN: If buffer full dump to disc State = 14 until buffer empty
NN = 12 REPLACE AND DIRECT TO TELETYPE	LOG OUT: Always replace message LOG IN: If buffer full, dump to disc State = 14, until buffer empty.	LOG OUT: Always replace message LOG IN: If buffer full, dump to disc State=14, until buffer empty.	LOG OUT: Always replace message LOG IN: If buffer full dump to disc State=14, until buffer empty

9.2. CALLS TO FROST

9.2.13. Send a Message to the Controllee

This call is used to startup a controllee. The controller is suspended and the controllee activated. A message may be sent from the problem program (controller) to its controllee.

Format:

Word 0: 00000 00000 1004A AAAAA

where:

AAAAAA is the address of word ALPHA.

Word ALPHA: 15ZZR ETURN CCMMB BBBBB

where:

15 is the code for "send a message to the controllee."

ZZ represents the bits ONDDDD,

where: N is the startup controllee option

N=0 Startup controllee with message

N=1 Startup controllee without a message

DDDD=00 Normal

DDDD=01 Set input bypass. Messages from a controller will bypass this problem program and be given to the controllee.

DDDD=02 Set output bypass. Messages from a controllee will bypass this problem program and be given to the controller.

DDDD=03 Set input and output bypass.

DDDD=10 Treat controller like a read only file (that is the controller of the controller becomes the controller of the controllee and any tapes belonging to the controller become controllee tapes). Any message of the controllers to the teletype which has not yet been output will be lost.

Return is an address. If this system call was not successfully completed, control will be sent to 'return'. If the call is successfully completed, control will be sent to 'return+1'.

CC=00 Do not resume this problem program if the controllee suspends waiting for a message from controller.

CC=01 Resume this problem program if the controllee suspends waiting for a message from controller and this program's input bypass is not on.

MM is the number of main-frame words in the message (MM must never be greater than fifteen)

BBBBBB is the address of word Beta, the beginning of the message storage area.

(Information deleted)

Sending a message causes the system to copy the message from problem program core into a system buffer and to start the controllee. If the input bypass is set and the controller is running in the situation teletype-controller-controllee, the controllee will be started with a teletype message.

9.2. CALLS TO FROST

CHARGE: 2 MILLISECONDS.

9.2.14. GET A MESSAGE FROM THE CONTROLLER

THIS CALL MAY BE USED BY A PROBLEM PROGRAM TO GET A MESSAGE FROM ITS CONTROLLER. IF A MESSAGE IS WAITING, IT IS DELIVERED TO THE REQUESTING PROBLEM PROGRAM. IF THERE IS NO MESSAGE WAITING, THE 'NN' OPTION FIELD WILL BE EXAMINED, AND THE INDICATED ACTION WILL TAKE PLACE.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 16NNR ETURN MM00B BBBB

WHERE:

16 IS THE CODE FOR 'GET A MESSAGE FROM THE CONTROLLER'.

NN INDICATES THE SUSPEND MODE:

NN=00 IF A MESSAGE IS NOT READY AND WAITING AT THE INSTANT THIS CALL IS GIVEN, THE PROBLEM PROGRAM IS SUSPENDED FROM CORE UNTIL SUCH TIME THAT A MESSAGE IS READY.

NN=01 IF A MESSAGE IS NOT READY AND WAITING AT THE INSTANT THIS CALL IS GIVEN, CONTROL WILL BE RETURNED TO LOCATION 'RETURN' WITH THE BUFFER UNTOUCHED.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

MM is the maximum number of main frame words to be delivered as a result of this call. If MM is zero, the entire message is delivered and may be up to 45 main-frame words.

BBBBB IS THE ADDRESS OF WORD BETA, THE BEGINNING OF THE MESSAGE STORAGE AREA.

GETTING A MESSAGE CAUSES THE SYSTEM TO COPY THE MESSAGE FROM A SYSTEM BUFFER INTO PROBLEM PROGRAM CORE. THE SYSTEM BUFFER IS DESTROYED.

CHARGE: 2 MILLISECONDS IF MESSAGE IS WAITING.

9.2. CALLS TO FROST

9.2.15. GET A MESSAGE FROM THE CONTROLLEE

This call may be used by a problem program to get a message from a controllee. If a message is waiting, it is delivered to the requesting problem program. If there is no message waiting, a word of all sevens (minus zero) or a word of all twos is delivered to the problem program in Beta, and the error return taken. The twos are given if this problem program was started up because it used option CC=01 on Frost Call 15, Send a Message to the Controllee. The sevens are given otherwise.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 1700R ETURN MM00B BBBB

WHERE:

17 IS THE CODE FOR 'GET A MESSAGE FROM THE CONTROLLEE'.

MM IS THE MAXIMUM NUMBER OF MAIN FRAME WORDS TO BE DELIVERED AS A RESULT OF THIS CALL (MM MUST NEVER BE GREATER THAN FIFTEEN).

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB IS THE ADDRESS OF WORD BETA, THE BEGINNING OF THE MESSAGE STORAGE AREA.

GETTING A MESSAGE CAUSES THE SYSTEM TO COPY THE MESSAGE FROM A SYSTEM BUFFER INTO PROBLEM PROGRAM CORE. THE SYSTEM BUFFER IS DESTROYED.

CHARGE: 2 MILLISECONDS.

9.2.16. GET SYMBOLS FROM THE CONTROLLER

THIS CALL IS IDENTICAL TO 'GET A MESSAGE FROM THE CONTROLLER', DESCRIBED ON PAGE 21, EXCEPT THAT THE MESSAGE IS DELIMITED INTO RIGHT-JUSTIFIED SYMBOLS *(4)* ACCORDING TO CERTAIN RULES. THE SYMBOLS ARE PLACED IN SEPARATE SEQUENTIAL COMPUTER WORDS.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

(4) A SYMBOL IS DEFINED TO BE LESS THAN ELEVEN CHARACTERS.

9.2. CALLS TO FROST

WORD ALPHA: 20NNR ETURN MMDBB BBBBBB

WHERE:

20 IS THE CODE FOR 'GET SYMBOLS FROM THE CONTROLLER'.

NN INDICATES THE SUSPEND MODE:

NN-00 IF SYMBOLS ARE NOT READY AND WAITING AT THE INSTANT THIS CALL IS GIVEN, THE PROBLEM PROGRAM IS SUSPENDED FROM CORE UNTIL SUCH TIME THAT A MESSAGE IS READY.

NN-01 IF SYMBOLS ARE NOT READY AND WAITING AT THE INSTANT THIS CALL IS GIVEN, CONTROL WILL BE RETURNED TO LOCATION 'RETURN' WITH THE BUFFER UNTOUCHED.

MM IS THE MAXIMUM NUMBER OF MAIN FRAME WORDS TO BE DELIVERED AS A RESULT OF this call. If MM is zero all symbols will be delivered. The maximum is 150.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

DD INDICATES WHAT CHARACTERS ARE TO BE USED AS SYMBOL DELIMITERS:

DD-00 CAUSES SYMBOLS TO BE DELIMITED BY SPACES AND LINE SEPARATORS.

DD-01 CAUSES SYMBOLS TO BE DELIMITED BY SPACE, LINE SEPARATOR, COMMA, PERIOD, SEMICOLON, LEFT PARENTHESIS, RIGHT PARENTHESIS, left bracket, and right bracket.

DD-04 causes symbols to be delimited by 6-bit ASCII characters specified in the Beta array (one delimiter right-adjusted per Beta word). There can be a maximum of 10 delimiters. A Beta word which contains a negative integer ends the list. If no delimiters are set, only 18-bit character strings beginning with an "at" (@) character (40 octal) are delimiters. These are always delimiters.

BBBBBB IS THE ADDRESS OF WORD BETA, THE BEGINNING OF THE MESSAGE STORAGE AREA. EACH INCOMING SYMBOL IS RIGHT JUSTIFIED INTO A SEPARATE WORD STARTING AT WORD BETA.

GETTING A MESSAGE CAUSES THE SYSTEM TO COPY THE MESSAGE FROM A SYSTEM BUFFER INTO PROBLEM PROGRAM CORE. THE SYSTEM BUFFER IS DESTROYED.

DELIMITERS ARE TREATED AS BLANKS, IN THE SENSE THAT THEY CAUSE PREVIOUS CONTIGUOUS NON-DELIMITER CHARACTERS TO BE STORED AS A SYMBOL. HOWEVER, A NON-BLANK DELIMITER (IF USED) IS STORED AS THE NEXT SEQUENTIAL SYMBOL. MULTIPLE BLANKS ARE TREATED LIKE A SINGLE blank when blank is used as a delimiter.

ON A 'GET SYMBOLS' CALL REQUESTING MORE SYMBOLS THAN SENT, THE SYMBOL AFTER THE LAST SYMBOL SENT WILL BE RECEIVED AS 400204.

THE 'AT' CHARACTER (40 OCTAL) ALWAYS SIGNALS THE BEGINNING OF AN EIGHTEEN-BIT TTY-TRIO (40XXXX) IN THE EXTENDED ASCII CHARACTER SET *(5)*.

CHARGE: 2 MILLISECONDS IF MESSAGE IS WAITING.

(5) SEE SECTION 3.3.1.

9.2. CALLS TO FROST

9.2.17. GET SYMBOLS FROM THE CONTROLLEE
.....

THIS CALL IS SIMILAR TO 'GET A MESSAGE FROM THE CONTROLLEE', DESCRIBED ON PAGE 22, EXCEPT THAT THE MESSAGE IS DELIMITED INTO RIGHT-JUSTIFIED SYMBOLS *(6)* ACCORDING TO CERTAIN RULES. THE SYMBOLS ARE PLACED IN SEPARATE SEQUENTIAL COMPUTER WORDS. IF THE SYMBOLS ARE NOT READY AND WAITING, THE ERROR RETURN WILL BE TAKEN with a word of either 7's or 2's stored in BETA (7's if the PP is running because of an interrupt from Teletype, and 2's if the PP is running because its controllee suspended waiting for a message from controller).

BE STORED.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 2100R ETURN MMDDDB BBBBDB

WHERE:

21 IS THE CODE FOR 'GET SYMBOLS FROM THE CONTROLLEE'.

MM IS THE MAXIMUM NUMBER OF MAIN FRAME WORDS TO BE DELIVERED AS A RESULT OF THIS CALL. If MM is zero, a maximum of 150 characters may be delivered.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

DD INDICATES WHAT CHARACTERS ARE TO BE USED AS SYMBOL DELIMITERS:

DD=00 CAUSES SYMBOLS TO BE DELIMITED BY SPACES AND LINE SEPARATORS.

DD=01 Causes symbols to be delimited by space, line separator, comma, period, semicolon, left parenthesis, right parenthesis, left bracket, and right bracket.

DD=04 Causes symbols to be delimited by 6-bit ASCII characters specified in the BETA array (one delimiter right-adjusted per BETA word). There can be a maximum of 10 delimiters. A BETA word which contains a negative integer ends the list. If no delimiters are set, only 18-bit character strings beginning with an "at" (@) character (40 octal) are delimiters. These are always delimiters.

BBBBBB IS THE ADDRESS OF WORD BETA, THE BEGINNING OF THE MESSAGE STORAGE AREA. EACH INCOMING SYMBOL IS RIGHT JUSTIFIED INTO A SEPARATE WORD STARTING AT WORD BETA.

GETTING A MESSAGE CAUSES THE SYSTEM TO COPY THE MESSAGE FROM A SYSTEM BUFFER INTO PROBLEM PROGRAM CORE. THE SYSTEM BUFFER IS DESTROYED.

THE 'AT' CHARACTER (40 OCTAL) ALWAYS SIGNALS THE BEGINNING OF AN EIGHTEEN-BIT TTY-TRIO (40XXXX) IN THE EXTENDED ASCII CHARACTER SET *(7)*.

CHARGE: 2 MILLISECONDS IF SYMBOLS ARE WAITING.

.....
(6) A SYMBOL IS DEFINED TO BE LESS THAN ELEVEN CHARACTERS.

(7) SEE SECTION 3.3.1.

9.2. CALLS TO FRST

9.2.18. INITIALIZE OR DISCONNECT A CONTROLLEE

THIS CALL MAY BE USED BY A PROBLEM PROGRAM TO INITIALIZE OR DISCONNECT A CONTROLLEE. BEFORE A PROBLEM PROGRAM STARTS A CONTROLLEE, CERTAIN PARAMETERS MUST BE SET AND/OR VERIFIED.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 22NNR ETURN 0000B BBBB

WHERE:

22 IS THE CODE FOR 'INITIALIZE OR DISCONNECT A CONTROLLEE'.

NN INDICATES WHETHER INITIALIZE OR DISCONNECT IS DESIRED.

NN=00 INITIALIZE (ERROR IF A CONTROLLEE IS ALREADY PRESENT).

NN=01 DISCONNECT (ERROR IF THERE IS NO SUCH CONTROLLEE).

NN=02 INITIALIZE A CONTROLLEE AT A PRIORITY OTHER THAN THE CONTROLLER'S.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB IS THE ADDRESS OF A WORD, BETA, CONTAINING THE NAME OF THE PROBLEM TO BE STARTED.

WORD BETA: CONTROLLEE FILE NAME (ASCII, RIGHT JUSTIFIED).

WORD BETA+1: 00XXX XXXTT TTTT TTTT

WHERE:

XXXXXX IS THE SIZE AT WHICH TO START THE CONTROLLEE. IF XXXXXX = 0, SIZE IS FILE LENGTH MINUS 256 (DEC).

TT...T IS THE TIME LIMIT FOR THIS PROBLEM PROGRAM IN MICROSECONDS. NOTE THAT THIS DOES NOT CHANGE THE PRIORITY. IF TT...T = 0, TIME IS TAKEN FROM CONTROLLER'S TIME LIMIT.

WORD BETA+2: THE FLOATING POINT PRIORITY VALUE TO BE USED FOR THE CONTROLLEE IF NN = 02. IF 'BETA+2' IS ZERO, THE CONTROLLER'S PRIORITY WILL BE USED FOR THE CONTROLLEE WITH NO INDICATION OF THIS FACT BEING GIVEN TO THE CONTROLLER. IF 'BETA+2' IS NOT FLOATING POINT, OR IS NEGATIVE, THE ERROR RETURN WILL BE TAKEN. IF 'BETA+2' HAS A CHARACTERISTIC OF 1777 OR 3777, THE ERROR RETURN WILL BE TAKEN.

6600 SYSTEM CALLS AND I/O REQUESTS CIC-LTSS-9-ED.3

5/27/69

PAGE 26

9.2. CALLS TO FROST

THIS CALL DOES NOT START THE CONTROLLEE. THE PROBLEM PROGRAM MUST SEND A MESSAGE TO THE CONTROLLEE TO START IT. AN ERROR RETURN WILL BE TAKEN IF THE FILE SIZE OF THE CONTROLLEE IS LESS THAN 401 (OCTAL) OR GREATER THAN 303,337 (OCTAL).

CHARGE: 2 MILLISECONDS.

9.2.19. CLOSE

THIS CALL MAKES IT POSSIBLE FOR THE REQUESTING PROBLEM PROGRAM TO SEVER ITS CONNECTION WITH A DISC FILE OR SET OF DISC FILES WITHOUT AFFECTING THE STATUS OF THE FILE(S) IN QUESTION *(8)*.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 23NNR ETURN 0000B BBBB

WHERE:

23 IS THE CODE FOR 'CLOSE'.

NN IS THE NUMBER OF FILES REQUESTED.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB IS THE ADDRESS OF THE FIRST WORD, BETA, OF THE NN (LESS THAN 17 DECIMAL) REQUESTS.

WORD BETA: MMRRS 50000 00000 00000

WHERE:

MM IS THE MINUS WORD OF THE FILE TO BE CLOSED.

RR INDICATES THE READ/WRITE STATUS:

RR=00 NO CHANGE.

RR=01 MAKE THIS FILE A READ ONLY FILE, STARTING NOW.

RR=02 MAKE THIS FILE A READ/WRITE FILE, STARTING NOW.

RR=04 Make this file execute-only, now.

SS IS FILLED IN (BY FROST) ON COMPLETION OF THE SYSTEM CALL, AS FOLLOWS:

SS=00 NORMAL COMPLETION.

SS=04 ACCESS DENIED.

 (8) COMPARE 'DESTROY', PAGE 7.

9.2. CALLS TO FROST

WORD BETA+1: SAME AS BETA

```

..      .
..      .
..      .

```

IF RR = 02 AND THE FILE IS PUBLIC, ACCESS WILL BE DENIED.

UPON COMPLETION, ZEROES ARE PLACED IN THE CORRESPONDING MINUS WORDS, MEANING THAT THIS FILE HAS BEEN REMOVED FROM THE PROBLEM PROGRAM'S LIST OF INPUT/OUTPUT EQUIPMENT.

CHARGE: 2 MILLISECONDS.

9.2.20. TIME LIMIT, USER NUMBER, BANK ACCOUNT, PRIORITY, ETC.
.....

THIS CALL ALLOWS THE REQUESTING PROBLEM PROGRAM TO MODIFY ITS TIME LIMIT; TO GET ITS USER IDENTIFICATION NUMBER AND BANK ACCOUNT; TO CHANGE ITS PRIORITY; TO GET ITS CURRENT TIME LIMIT AND PRIORITY; TO GET THE PERCENTAGE TIME CHARGED; TO GET THE PROBLEM PROGRAM NAME AND FIELD LENGTH; OR TO GET THE DESCRIPTOR BLOCK AND USER BLOCK TABLES.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

Word ALPHA: 24NNR ETURN 0000B BBBB

where:

24 is the code for this system call.

NN indicates which option is desired:

NN=00 means modify time limit.

NN=01 means get user identification number and current bank account.

NN=02 means change priority.

NN=03 means get time limit and priority.

NN=04 means get percentage time charged.

NN=05 means get problem program name and field length.

NN=06 means get descriptor block and user block tables.*

NN=11 means get user number, current bank account, and division number.

NN=15 means get controllee's name and field length.

NN=16 means get bank-account table.

NN=25 means get controller's name and field length.

NN=26 means get file-index table.**

NN=33 means get account number, suffix if logged in, protection level, suffix if logged in or not.

*See Chapter 2.

**See Appendix B for formats of these tables.

NN=36 means get disk-map table.*

NN=46 means get correspondence table.*

RETURN is an address. If this system call was not successfully completed, control will be sent to "return." If the call is successfully completed, control will be sent to "return+1."

BBBBB is the address of a word, BETA, whose format is described below.

*See Appendix B for formats of these tables.

9.2. CALLS TO FROST

WORD DATA:

NN = 00: THE NEW TIME LIMIT, IN INTEGER MICROSECONDS, FROM THE PROBLEM PROGRAM.

NN = 01: FILLED IN BY FROST WITH THE RIGHT JUSTIFIED ASCII USER IDENTIFICATION NUMBER.

NN = 02: THE NEW PRIORITY, IN FLOATING POINT, PROVIDED BY THE PROBLEM PROGRAM. IF ZERO, NO CHANGE WILL BE EFFECTED.

NN = 03: FILLED IN BY FROST WITH THE EXISTING TIME LIMIT, IN INTEGER MICROSECONDS.

NN = 04: FILLED IN BY FROST WITH THE ASCII PERCENTAGE CHARGE DISTRIBUTION, NON-PRIORITY HEIGHTED, AS
 bbxx:yy:zz
 WHERE:
 bb ARE TWO BLANK CHARACTERS
 xx IS THE PER CENT OF TOTAL TIME CHARGED FOR CPU USAGE.
 yy IS THE PER CENT OF TOTAL TIME CHARGED FOR I/O.
 zz IS THE PER CENT OF TOTAL TIME CHARGED FOR SYSTEM CALLS.
 VALUES IN THESE FIELDS WILL BE SET TO ZERO WHEN THE CALL IS MADE, SO THAT A SUBSEQUENT CALL WILL REFLECT PERCENTAGES OF TIME USED SINCE THE LAST PREVIOUS CALL. THESE VALUES PERTAIN TO A GIVEN DESCRIPTOR BLOCK (I.E., A SINGLE PROBLEM PROGRAM) ONLY.

NN = 05: FILLED IN BY FROST WITH THE RIGHT-JUSTIFIED ASCII PROBLEM PROGRAM NAME.

NN = 06: POINTS TO THE FIRST WORD ADDRESS OF A BUFFER. THIS BUFFER MUST BE 2300 (DECIMAL) WORDS IN LENGTH. AN ERROR RETURN IS GIVEN IF THE FIRST WORD ADDRESS PLUS 2300 (DECIMAL) EXCEEDS THE PROGRAM FIELD LENGTH. THE SYSTEM WILL RETURN TO THIS BUFFER THE FOLLOWING:

Words 1-N	- The descriptor block table (16 words/block).
Words N+1	- A word of 2's: 222...2.
Words (N+2)-M	- The user block table (7 words/block).
Word M+1	- A word of 2's: 222...2.

NOTE: M, N are unknown, but $M < 2300$.

NN=11 same as NN=01.

NN=15 filled in by FROST with controllee's name, ASCII right justified.

NN=16 first-word address of a 180₁₀-word buffer.

NN=25 filled in by FROST with controller's name, ASCII right justified.

NN=26 first-word address of a buffer 4352₁₀ words long.

NN=33 filled in by FROST.

Format: XXCCS S0DAA AAAAA AAAAA

where:

XX will contain the ASCII code for the caller's suffix if the teletype is logged in under the caller's suffix; otherwise it will be zero.

CC will contain the caller's protection level, an integer number 0-7.

SS will contain the ASCII code for the caller's suffix (A, B, C, or D).

D is the operating level of the machine (default level).

AA will contain the ASCII code for the account number of the caller.

NN=36 first-word address of a buffer 1024₁₀ words long.

NN=46 first-word address of a buffer 28₁₀ words long.

Word BETA+1: NN=00 filled in by FROST with the value of the time limit, in integer microseconds, at the time this call was made (prior to installing the new time limit).

NN=01 filled in by FROST with the current value of the bank account, in integer microseconds.

NN=02 filled in by FROST with the existing priority, in floating point, at the time the call is made.

NN=03 filled in by FROST with the existing priority, in floating point, at the time the call is made.

NN=04 filled in by FROST with the total number of integer microseconds used since the last previous call. This is the base of the percentages used in word BETA.

9.2. CALLS TO FROST

NN=05 filled in by FROST with the binary field length of the file.

NN=11 same as NN=01.

NN=15 filled in by FROST with the binary field length of the controllee.

NN=25 filled in by FROST with the binary field length of the controller.

NN=26 filled in by FROST with absolute first-word address of file-index table.

Word BETA+2: NN=11 filled in by FROST with the (6 bit binary) division number.

9.2. CALLS TO FROST

OPTION NN = 02 WILL CAUSE THE PROBLEM PROGRAM TO BE DUMPED TO DISC AND QUEUED FOR RELOAD AT THE NEW PRIORITY. THE ERROR RETURN WILL BE TAKEN IF NN > 03, IF THE NEW PRIORITY IS NOT A POSITIVE FLOATING POINT NUMBER, OR IF THE NEW PRIORITY HAS A CHARACTERISTIC OF 1777 OR 3777.

The format of the bank-account table (NN=16), for each word, is:
USNO DIV BANK where USNO = binary user number (20 bits),
 DIV = division code (6 bits), and BANK = time remaining in bank account (34 bits).

Change: 2 milliseconds, except for 1.2 seconds for NN=06.

9.2.21. AUTOMATIC SUSPEND AND RESTART

THIS CALL SUSPENDS THE PROBLEM PROGRAM ISSUING THE CALL AND AUTOMATICALLY RESTARTS IT AT A LATER TIME.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 2500R ETURN 0000B BBBB

WHERE:

25 IS THE CODE FOR 'AUTOMATIC SUSPEND AND RESTART'.

RETURN IS AN ADDRESS. IF THIS SYSTEM CALL HAS NOT SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN'. IF THE CALL IS SUCCESSFULLY COMPLETED, CONTROL WILL BE SENT TO 'RETURN+1'.

BBBBB IS THE ADDRESS OF A WORD, BETA, CONTAINING THE LENGTH OF THE SUSPENSION, IN INTEGER MICROSECONDS.

THE SUSPEND LENGTH MUST BE BETWEEN THIRTY SECONDS AND THIRTY MINUTES. THE ERROR RETURN WILL BE TAKEN IF THE PROBLEM PROGRAM OWNS A TAPE, OR HAS A CONTROLLER OTHER THAN TELETYPE, OR HAS A CONTROLLEE.

AT THE TIME THIS CALL IS ISSUED, THE JOB WILL BE SUSPENDED FROM ALL OPERATION FOR THE PERIOD SPECIFIED, AND WILL BE IN STATE = 31. AT THE END OF THE SUSPENSION PERIOD, THE JOB WILL BE PUT INTO A STATE = 11 AND WILL BE ELIGIBLE TO RUN AGAIN. CONTROL WILL THEN BE SENT TO 'RETURN+1'.

CHARGE: 2 milliseconds plus load and dump charges of 64 milliseconds
 + (4 microseconds * problem program field length)

9.2. CALLS TO FROST

9.2.22. MESSAGE BYPASS CONTROL

THIS CALL ALLOWS A PROBLEM PROGRAM TO TURN INPUT AND/OR OUTPUT BYPASSES ON OR OFF. IF A PROBLEM PROGRAM'S OUTPUT BYPASS IS TURNED OFF, THEN IT WILL RECEIVE MESSAGES GENERATED BY ITS CONTROLLEE; IF ITS OUTPUT BYPASS IS TURNED ON, THEN MESSAGES SENT BY ITS CONTROLLEE WILL BYPASS THIS PROBLEM PROGRAM AND GO TO THE NEXT HIGHER CONTROLLER PROBLEM PROGRAM WHOSE OUTPUT BYPASS IS TURNED OFF. IF A PROBLEM PROGRAM'S INPUT BYPASS IS TURNED OFF, THEN IT WILL RECEIVE MESSAGES GENERATED BY ITS CONTROLLER; IF ITS INPUT BYPASS IS TURNED ON, THEN MESSAGES SENT BY ITS CONTROLLER WILL BYPASS THIS PROBLEM PROGRAM AND GO TO THE NEXT LOWER CONTROLLEE WHOSE INPUT BYPASS IS TURNED OFF.

FORMAT:

WORD 0: 00000 00000 1004A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF WORD ALPHA.

WORD ALPHA: 26NNR ETURN JJMMO 00000

WHERE:

26 IS THE CODE FOR 'BYPASS CONTROL'.
NN DETERMINES THE TYPE OF BYPASS:
NN=01 REFERS TO INPUT BYPASS.
NN=02 REFERS TO OUTPUT BYPASS.
NN=03 REFERS TO BOTH INPUT AND OUTPUT BYPASSES.
JJ DETERMINES THE NATURE OF THE BYPASS:
JJ=00 IMPLIES TURN OFF BYPASS.
JJ=01 IMPLIES TURN ON BYPASS.
MM STANDS FOR PROBLEM PROGRAM, CONTROLLER, OR CONTROLLEE:
MM=01 REFERS TO PROBLEM PROGRAM.
MM=02 REFERS TO CONTROLLEE.
MM=03 REFERS TO CONTROLLER.

IF MM = 02 AND THERE IS NO CONTROLLEE, OR IF MM = 03 AND THERE IS NO CONTROLLER PROBLEM PROGRAM, CONTROL WILL BE SENT TO 'RETURN'.

THE 'SEND MESSAGE TO CONTROLLEE' *(10)* SYSTEM CALL DIFFERS FROM THE 'BYPASS CONTROL' IN THAT ONCE THE FORMER HAS TURNED THE BYPASS ON, THERE IS NO WAY TO TURN IT OFF EXCEPT BY DISCONNECTING AND RE-INITIALIZING THE PROBLEM PROGRAM.

CHARGE: 2 MILLISECONDS.

.....

(10) SEE PAGE 19.

9.2.23. SEND A MESSAGE TO DEVICE

This call allows a problem program to send messages to non-teletype remote devices (such as file transport, TMDS, and remote terminals) provided: (1) the FROST system has the remote machine in its remote machine number table, (2) the remote machine is not one of those under system control only, and (3) the access information level of the remote machine is higher than or equal to that of the user program. Buffer sizes of 0 to 512 60-bit words can be transferred. A 96-bit message header constructed by FROST (or the remote machine on input) precedes each buffer. It contains information necessary to route the message, and tells the destination what to do with it.

Format:

Word ZERO: 00000 00000 1004A AAAAA

where:

AAAAAA is the address of word ALPHA.

Word ALPHA: 31NNR ETURN 0000B BBBBB

where:

31 is the code to "send a message to device."

NN indicates the suspend mode:

NN=00 If the message can't be sent at this instant,
 control will be returned to location "RETURN."

NN=01 If the message can't be sent at this instant,
 suspend the requesting problem program in
 state 22 until the message is sent.

RETURN is an address. If this system call was not
 successfully completed, control will be sent to
 "RETURN." If the call is successfully completed,
 control will be sent to "RETURN + 1."

BBBBBB is the address of Word BETA, the beginning of a
 two-word array.

Word BETA: 00SSD DDDDD MMMMX XXXXX

where:

SS is filled (by FROST) on completion of the system call, as follows:

SS=00 normal; message was copied into system buffer.

SS=01 when NN=00, and the preceding message to a device has not yet been sent from the system buffer to the device.

SS=02 User access is denied to this device.

SS=03 MMMM field error.

SS=04 when NN=00, and the system output queue is too long for this device.

DDDDDD Machine-device identification number.

MMMM is the number of main-frame words in the message.

XXXXXX is the address of the beginning of the message.

Word BETA+1: The low-order 16 bits contain message-header type-control information:

bit 2^{15} First Identifies this message as the first of a sequence of messages.

bit 2^{14} Last Identifies this message as the last of a sequence of messages.

bit 2^{13} Error If message can't reach its destination, it will be returned to the sender with the error bit on unless the error bit is already on, in which case the message is lost.

bit 2^{12} Convert If zero, FROST will convert input teletype messages from 8- to 6-bit ASCII and output teletype messages from 6- to 8-bit ASCII only when the system provides this service for source and destination machines and when the message buffer is less than 16 60-bit words.

bits $2^8 - 2^{11}$	Type	Defines kind of information in this message.
bits $2^1 - 2^7$	Control	Meaning depends on the type.
bit 2^0	Chain	The 96-bit header may be extended by setting the chain bit. Any additional header must occupy consecutive 48-bit bytes (left justified overlapping word boundaries) in the message buffer. The 2^0 bit of each header byte is a chain bit. The header is terminated, and text begins at a zero chain bit. The number of words in the message required by this call is the total number of 60-bit words in the problem program's message buffer, including possible header extensions and message text.

A message of zero length means only the 96-bit header is transmitted.

9.2.24. GET A MESSAGE FROM DEVICE

This call allows a problem program to receive messages from non-teletype remote devices. It is the input version of FROST call "Send a Message to Device" and has the same limitations. The input messages are queued up and given to the user in order, one at a time.

Format:

Word ZERO: 00000 00000 1004A AAAAA

where:

AAAAAA is the address of word ALPHA

Word ALPHA: 32NNR ETURN 0000B BBBB

where 32 is the code to "get a message from device."

NN indicates the suspend mode:

NN=00 If there is no message waiting at this instant, control will be returned to location "RETURN."

NN=01 If there is no message waiting at this instant, suspend the requesting problem program in state 23₍₈₎.

RETURN is an address. If this system call was not successfully completed, control will be sent to "RETURN." If the call is successfully completed, control will be sent to "RETURN + 1."

BBBBBB is the address of Word BETA, the beginning of a three-word array.

Word BETA: 00SSD DDDDD MMMMX XXXXX

where: SS is filled (by FROST) on completion of the system call, as follows:

SS=00 Normal return — a message from device was copied from a system buffer into the problem program. DDDDDD contains the machine device identification number which sent the message. BETA + 2 contains the size of the message. No teletype message has been received.

SS=01 when NN=00, and as yet no message has arrived.

SS=03 normal return; a message has been received from the user's teletype. It can be picked up by issuing an appropriate 'get symbols or get message from controller' FROST call. A message from device may or may not have been received and copied into the problem program, depending whether or not DDDDDD is non-zero.

DDDDDD (filled in by FROST) machine-device identification number.

MMMM is the maximum number of main-frame words to be delivered as a result of this call.

XXXXXX is the address of the beginning of the message-storage area.

Word BETA+ 1: The low-order 16 bits are filled in by FROST and will contain any message-header type-control information received.

Word BETA+ 2: PPPPP PNNNN LLLLL LKKKK
 where:

 PPPPPP (filled in by FROST) is the machine-device identification number associated with the next message in the queue, if there is one.

 NNNN (filled in by FROST) is the number of words in the message received from device DDDDDD.

 LLLLLL (filled in by FROST) is a flag which if nonzero, means an input message from the source-machine device-number, LLLLLL, was lost because the system-device input queue was too long.

 KKKK (filled in by FROST) is the size of the lost input message.

9.3. CALLS TO CMPPU

9.3.1. REQUEST TIME CLOCK

.....

THIS CALL ALLOWS ONE TO GET THE CONTENTS OF THE 6600 REAL TIME CLOCK.

FORMAT:

WORD 0: 00000 00000 UU01A AAAAA

WHERE:

UU INDICATES WHICH CLOCK IS REQUESTED:

UU=00 means store the current microsecond charge (including the I/O, CPU, and system-call charges, non-priority-weighted) into location AAAAAA and return control for location AAAAAA+3. (The current microsecond charge is cleared every time the job leaves the alternator loop.)

UU=01 MEANS STORE THE CURRENT READING OF THE SIXTY-BIT CLOCK IN LOCATION AAAAAA AND TRANSFER CONTROL TO LOCATION AAAAAA+1. THE SIXTY-BIT CLOCK CONTAINS THE NUMBER OF ELAPSED MICROSECONDS SINCE JANUARY 1, 1965.

UU=02 MEANS STORE THE CURRENT READING OF THE LRL MASTER COMPUTER CLOCK IN LOCATION AAAAAA AND TRANSFER CONTROL TO LOCATION AAAAAA+1.

AAAAAA IS THE ADDRESS OF A PARTICULAR CORE LOCATION.

THE FORMAT FOR THE LRL MASTER CLOCK (IN BITS) IS:

CNNNNDDDDDD CHHHHHMMMM CMSSSSSSLL CLLLLLLLLLLP 000000IIIIII

WHERE:

C=1 MEANS THAT THE CLOCK IS CHANGING.

P=C MEANS POWER FAILURE.

NNNNN IS MONTHS.

DDDDDD IS DAYS.

HHHHHH IS HOURS.

MMMMMM IS MINUTES.

SSSSSS IS SECONDS.

LL...L IS MILLISECONDS.

IIIIII IS THE ASCII CHARACTER FOR THE MACHINE IDENTIFICATION (C, L, M, OR N).

EXCEPT FOR THE MACHINE IDENTIFICATION AND THE C AND P BITS, THESE BITS CONTAIN A MODIFIED FORM OF BCD. EACH GROUP OF FOUR BITS, COUNTING FROM RIGHT TO LEFT, CAN CONTAIN THE VALUES 0000 (0) TO 1001 (9).

CHARGE: NONE.

9.3. CALLS TO CMPPU

9.3.2. GIVE UP CPU -- NEXT TURN

THE REQUESTING PROBLEM PROGRAM WILL GET NO MORE CPU TIME UNTIL THE PROBLEM PROGRAM'S NEXT TURN IN THE ALTERNATOR LOOP.

FORMAT:

WORD 0: 00000 00000 0002A AAAAA

WHERE:

AAAAAA IS THE ADDRESS WHERE THE PROBLEM PROGRAM IS TO BE RESTARTED.

CHARGE: NONE.

9.3.3. GIVE UP CPU -- I/O

THE REQUESTING PROBLEM PROGRAM WILL GET NO MORE CPU TIME UNTIL EACH OF THE SPECIFIED INPUT OR OUTPUT JOBS HAS BEEN COMPLETED.

GIVE UP CPU UNTIL ALL INPUT/OUTPUT IS COMPLETE (KTC-KNOWLEDGE OF TOTAL COMPLETION).

FORMAT:

WORD 0: 00000 00000 0010A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF A PARTICULAR CORE LOCATION. WHEN ALL INPUT/OUTPUT FOR THIS PROBLEM PROGRAM HAS FINISHED, THE PROBLEM PROGRAM WILL BE RESTARTED AT LOCATION AAAAAA. THIS CALL MIGHT BE USED AT THE END OF A PROBLEM PROGRAM WHEN THE PROBLEM PROGRAM MUST WAIT UNTIL ALL OUTPUT IS FINISHED BEFORE IT SIGNALS THAT IT HAS FINISHED.

9.3. CALLS TO CMPPU

GIVE UP CPU UNTIL CERTAIN INPUT/OUTPUT IS COMPLETE (KOC-KNOWLEDGE OF COMPLETION).

FORMAT:

WORD 0: 00000 00000 CC10A AAAAA

WHERE:

CC IS A NUMBER BETWEEN ONE AND FIFTEEN, AND IS THE IDENTIFICATION NUMBER DESCRIBED IN FIELD CCCC OF AN IOD *(11)*.

AAAAAA IS THE ADDRESS OF A PARTICULAR CORE LOCATION. WHEN ALL OUTSTANDING IOD'S WITH THE IDENTIFICATION NUMBER CC HAVE TERMINATED AND THE INTERRUPT ROUTINE FOR THE LAST SUCH IOD HAS FINISHED, CONTROL WILL BE SENT TO LOCATION AAAAAA. IF NO INTERRUPT ROUTINE HAS BEEN SPECIFIED, CONTROL IS SENT TO AAAAAA AFTER THE INPUT/OUTPUT JOBS IN QUESTION HAVE BEEN COMPLETED. IF A CONTINGENT IOD WAS SPECIFIED INSTEAD OF AN INTERRUPT ROUTINE, IT WILL HAVE BEEN PICKED UP BY CMPPU JUST BEFORE TRANSFER TO AAAAAA.

GIVE UP CPU UNTIL NEXT INPUT/OUTPUT COMPLETION (KFC-KNOWLEDGE OF FIRST COMPLETION).

FORMAT:

WORD 0: 00000 00000 4010A AAAAA

WHERE:

AAAAAA IS THE ADDRESS OF A PARTICULAR CORE LOCATION. WHEN THE VERY NEXT INTERRUPT ROUTINE HAS FINISHED, THE PROBLEM PROGRAM WILL BE RESTARTED AT LOCATION AAAAAA. IF NO INTERRUPT ROUTINE HAS BEEN SPECIFIED, CONTROL IS SENT TO AAAAAA AFTER THE INPUT/OUTPUT JOB IN QUESTION HAS BEEN COMPLETED. IF A CONTINGENT IOD WAS SPECIFIED INSTEAD OF AN INTERRUPT ROUTINE, IT WILL HAVE BEEN PICKED UP BY CMPPU JUST BEFORE TRANSFER TO AAAAAA.

CHARGE: NONE.

9.3. CALLS TO CMPPU

9.3.4. RETURN FROM AN INTERRUPT ROUTINE

THIS CALL IS FOR USE WITH THE INTERRUPT OPTIONS OF INPUT/OUTPUT OPERATIONS. CONTROL FOR THE REQUESTING PROBLEM PROGRAM IS TRANSFERRED TO THE POINT OF INTERRUPTION AT THE TIME OF THE INPUT/OUTPUT COMPLETION. ALL REGISTERS ARE RESET TO THEIR CONTENTS AT TIME OF INTERRUPTION.

FORMAT:

WORD 0: 00000 00000 00200 00000

RETURN TO WHERE THE PROBLEM PROGRAM WAS AT TIME OF THE INPUT/OUTPUT INTERRUPT.

CHARGE: NONE.

9.3.5. Set or Clear SCOPE Flag

Format:

Word 0: 00000 00000 0021A AAAAAA clears SCOPE flag

Word 0: 00000 00000 0022A AAAAAA sets SCOPE flag

This call sets the SCOPE flag and saves AAAAAA. Subsequent entries into the system when word one is nonzero (i. e., the standard method of issuing FROST I/O calls) will cause CMPPU to create a new exchange package with P-counter = AAAAAA, to store contents of word one into AAAAAA-1, and to run this new exchange package (in the same manner as I/O interrupt calls, so that a return from interrupt is necessary to transfer control back to the SCOPE code).

This call is intended to provide execution of SCOPE codes in the FROST system. (SCOPE system calls are passed via word one, instead of via word zero as in FROST calls.) If the SCOPE flag is off, then when word one is nonzero CMPPU processes the call as a standard FROST I/O call.

9.4. FORMAT FOR INPUT/OUTPUT REQUESTS

AN INPUT/OUTPUT (I/O) JOB IS DESCRIBED BY A FOUR-WORD BLOCK IN A PROBLEM PROGRAM CALLED AN IOD (INPUT/OUTPUT DESCRIPTOR). A DETAILED DESCRIPTION OF THE IOD FORMAT IS GIVEN BELOW.

NORMALLY, ONCE AN IOD HAS BEEN SUBMITTED, A PROBLEM PROGRAM SHOULD NOT MODIFY THE IOD UNTIL THE INPUT OR OUTPUT JOB HAS BEEN COMPLETED. SUCH MODIFICATIONS MAY RESULT IN PROBLEM PROGRAM ERRORS DUE TO INCORRECT DATA TRANSMISSIONS.

Before submitting an IOD, a problem program should begin by checking the contents of relative word one (that is, word one of the problem program's own memory). If the right-most twenty-four bits of word one are not zero, it means the previous IOD has not been picked up by the system. If the right-most twenty-four bits are zero it means the problem program is free to submit an IOD (the entire contents of word one is set to zero by CMPPU when the IOD has been picked up).

TO SUBMIT THE IOD, STORE THE FOLLOWING WORD IN RELATIVE WORD ONE:

XXXXX XXXXX XX00Z ZZZZZ

WHERE:

XX...X MAY BE ANYTHING.

ZZZZZ IS THE ADDRESS OF THE FIRST WORD, ZETA, OF THE IOD BEING SUBMITTED.

THE FOLLOWING IS A LIST OF AVAILABLE INPUT/OUTPUT PROGRAMS, WITH REFERENCES TO THE PAGES ON WHICH DETAILED INFORMATION MAY BE FOUND.

AAAA	PAGE	NAME OF I/O PROGRAM
----	----	-----
0002	41	READ EVEN PARITY (BCD) TAPE.
0006		ONE PROCESSOR DISC READ (CHANGED BY FROST TO 0412).
0007		ONE PROCESSOR DISC WRITE (CHANGED BY FROST TO 0413).
0014	41	DISPLAY ON 4480.
0015	42	WRITE EVEN PARITY (BCD) TAPE.
0016	42	SKIP TAPE RECORDS.
0017	42	Display on G machine scopes.
0025	42	Read/write central memory.
0077	42	ILLEGAL.
0410	43	READ ODD PARITY (BINARY) TAPE.
0411	44	WRITE ODD PARITY (BINARY) TAPE.
0412	44	DISC READ.
0413	45	DISC WRITE.
2000	46	READ TAPE UNIT STATUS.
2001	46	REWIND.
2002	46	REWIND UNLOAD.
2003	47	WRITE FILEMARK.
2010	47	SET DENSITY TO 200 BPI.
2011	47	SET DENSITY TO 556 BPI.
2012	47	SET DENSITY TO 800 BPI.

9.4. FORMAT FOR INPUT/OUTPUT REQUESTS

9.4.1. FORMAT OF AN IOD (BINARY)

```

ZETA
  AAAAAAAAAAA  RRVH--HWDDDD  LEEEE---CCCC  -----TTTTTT  TTTTTTTTTTTT

ZETA+1
  U-SSSSSSSSSS  BBBB BBBB BBBB  -----  XXXXXXXXXXXX  XXXXXXXXXXXX

ZETA+2
  GGGGGGGGGGGG  GGGGGGGGGGGG  -YYYYYYYYYYY  YYYYYY-ZZZZZ  ZZZZZZZZZZZZ

ZETA+3
  FFFFFFFFFFFF  JK---0111111  1111111111  NO---PMMMMMM  MMMMMMMMMMMM

```

FIELD CONTENT, MEANING, AND/OR USE

- A. TYPE OF JOB. EACH I/O PROGRAM (WRITE TAPE, READ CARDS, DISPLAY, ...) IS ASSIGNED A JOB NUMBER. THIS FIELD SPECIFIES WHICH I/O PROGRAM IS TO BE USED. SEE THE DESCRIPTION OF THE INDIVIDUAL I/O PROGRAMS IN SECTIONS 9.5.1 - 9.5.16 (PAGES 41 - 47).
- B. ADVANCED BY ONE EACH TIME THE IOD IS COMPLETED. THE I/O MECHANISM DOES NOT EXAMINE THIS FIELD. A TWELVE BIT ONE'S COMPLEMENT (END AROUND CARRY) ADDITION IS PERFORMED.
- C. IOD IDENTIFICATION NUMBER ASSIGNED BY THE PROBLEM PROGRAM. IT IS USED IN CONNECTION WITH THE 'GIVE UP CPU UNTIL I/O IS COMPLETED' SYSTEM CALL (SECTION 9.3.3, PAGE 32). THE CONVENTION IS THAT EVERY IOD WHOSE CCCC (BINARY) FIELD IS EQUAL TO THE CC (OCTAL) FIELD OF THE 'GIVE UP CPU' SYSTEM CALL MUST TERMINATE BEFORE THE 'GIVE UP CPU' IS SATISFIED AND THE PROBLEM PROGRAM IS RESUMED.
- D. MINUS-WORD DESIGNATION. INDICATES WHICH MINUS WORD CONTAINS THE DESCRIPTION OF THE I/O DEVICE USED IN THIS IOD.
- E. RESERVED FOR FUTURE USE.
- F. ERROR MESSAGE. IF THE I/O OPERATION WAS COMPLETELY TROUBLE FREE, THIS FIELD WILL CONTAIN ZERO. IF THERE WAS AN ERROR IN THE I/O OPERATION A MESSAGE WILL BE STORED HERE *(12)*.

.....
 (12) SEE SECTION 9.6.2, PAGE 48.

9.4. FORMAT FOR INPUT/OUTPUT REQUESTS

- G. IF THE I/O DEVICE IS A DISC, THIS IS THE FIRST DISC WORD ADDRESS FOR THE DISC OPERATION. IF THE DEVICE IS NOT A DISC, THIS FIELD TAKES ON VARIOUS MEANINGS FOR EACH DEVICE AND IS DESCRIBED INDIVIDUALLY FOR EACH I/O PROGRAM. IF THIS FIELD IS NOT SPECIFICALLY ASKED FOR BY THE I/O PROGRAM THE PROBLEM PROGRAM MAY USE IT TO STORE ANY DESIRED INFORMATION.
- H. Used by the system during a tape rewind. Must not be used by a problem program or altered between issuing a rewind IOD and completion of that IOD.
- I. THIS FIELD IS USED FOR ONE OF THREE PURPOSES:
 - 1. TO SPECIFY THE LOCATION OF THE PROGRAM'S INTERRUPT ROUTINE.
 - 2. TO SPECIFY THE LOCATION OF AN IOD TO BE EXAMINED AND PROCESSED ONLY AFTER THIS IOD HAS BEEN COMPLETED. THIS ALLOWS THE SIMPLE CONTINGENCY OF ONE I/O JOB ON ANOTHER WITHOUT REQUIRING CPU-CODED INTERRUPT ROUTINES. SEVERAL IOD'S MAY BE CHAINED TOGETHER THROUGH THE I-FIELD. THE (N+1)-ST IOD WILL NOT BE ISSUED UNTIL THE N-th IOD HAS BEEN PROCESSED AND COMPLETED.
 - 3. TO SPECIFY THAT NO ACTION IS TO BE TAKEN WHEN THIS IOD IS COMPLETED. IN THIS CASE THE FIELD MUST BE VOID.
- J. IF THIS BIT IS A ONE AND THE I-FIELD IS NOT ZERO, THEN I IS TAKEN TO CONTAIN THE ADDRESS OF A CONTINGENT IOD. OTHERWISE, I IS THE ADDRESS OF AN INTERRUPT ROUTINE.
- K. IF THIS BIT IS A ONE, ONCE THE INTERRUPT ROUTINE (SPECIFIED BY THE I-FIELD) FOR THIS IOD HAS BEEN ENTERED, ALL INTERRUPTS CAUSED BY OTHER IOD'S FOR THIS PROBLEM PROGRAM WILL BE INHIBITED UNTIL THE END OF THE INTERRUPT ROUTINE FOR THIS IOD.
- L. IF THIS BIT IS A ONE, THE TAPE WILL NOT BE ERASED ON A BAD TAPE WRITE.
- M. THIS FIELD IS USED TO SPECIFY ERROR CONTINGENCIES IN THREE WAYS:
 - 1. TO SPECIFY THE LOCATION OF A PROGRAM'S ERROR ROUTINE.
 - 2. TO SPECIFY THE LOCATION OF A CONTINGENT IOD TO BE EXECUTED IN CASE OF AN ERROR.
 - 3. IF VOID, THIS FIELD SPECIFIES NO ACTION.
- N. IF THIS BIT IS A ONE AND THE M-FIELD IS NOT ZERO, THEN M IS TAKEN TO CONTAIN THE ADDRESS OF A CONTINGENT IOD.
- O. IF THIS BIT IS A ONE, ONCE THE ERROR INTERRUPT ROUTINE (SPECIFIED BY THE M-FIELD) FOR THIS IOD HAS BEEN ENTERED, ALL INTERRUPTS CAUSED BY OTHER IOD'S FOR THIS PROBLEM PROGRAM WILL BE INHIBITED UNTIL THE END OF THE INTERRUPT ROUTINE FOR THIS IOD.
- P. =0 means problem terminated on a fatal I/O error.
 =1 means the user gets control if there is a fatal I/O error.
- Q. IF THIS IS A BCD TAPE OUTPUT IOD, THIS BIT IS COMPLEMENTED WHEN THE DATA HAS BEEN PICKED UP FROM THE PROBLEM PROGRAM'S MEMORY.

9.4. FORMAT FOR INPUT/OUTPUT REQUESTS

- R. THIS FIELD IS ONLY USED WITH DISC WRITE IOD'S. IF THE INITIAL ADDRESS AND/OR THE FINAL ADDRESS OF A DISC WRITE IOD IS NOT A MULTIPLE OF 100 (OCTAL), THE DISC WRITE PROGRAMS MUST READ THE PARTIAL SECTOR(S), INSERT THE NEW DATA, THEN WRITE BOTH THE OLD AND NEW DATA INTO THE PARTIAL SECTOR(S). IF IT IS KNOWN THAT THE UNREFERENCED PORTION(S) OF THE PARTIAL SECTOR(S) NEED NOT BE PRESERVED, THE READING STEP MAY BE BYPASSED AND THEREBY SPEED THE WRITING PROCESS.
- RR-00 MEANS PRESERVE THE UNREFERENCED PORTIONS OF THE FIRST AND LAST SECTORS SPECIFIED IN THIS DISC WRITE IOD.
 - RR-01 MEANS PRESERVE THE UNREFERENCED PORTION OF THE FIRST SECTOR SPECIFIED IN THIS DISC WRITE IOD.
 - RR-10 MEAN PRESERVE THE UNREFERENCED PORTION OF THE LAST SECTOR SPECIFIED IN THIS DISC WRITE IOD.
 - RR-11 MEANS DO NOT PRESERVE THE UNREFERENCED PORTIONS OF EITHER THE FIRST OR LAST SECTORS SPECIFIED IN THIS DISC WRITE IOD.
- S. PROGRAMMER INFORMATION. THIS INFORMATION WILL BE RETURNED IN REGISTER AO AT THE TIME OF THE EOP INTERRUPT AND/OR ERROR INTERRUPT. THIS COULD BE UTILIZED IN A GENERAL-INTERRUPT ROUTINE.
- T. THIS FIELD MAY BE USED TO SPECIFY THE ADDRESS OF ANOTHER IOD WHICH IS TO BE SUBMITTED AT THE SAME TIME AS THIS ONE. THIS FIELD PERMITS A CHAIN OF IOD'S TO BE ISSUED. THIS CHAIN DIFFERS FROM AN I-FIELD CHAIN IN THAT A T-FIELD IS NOT NECESSARILY AN ORDERED CHAIN. IOD'S FOR THE SAME DEVICE ARE PROCESSED IN THE order received, but CMPPU processes the totality of devices specified in a manner convenient to CMPPU.
- NOTE: ANY IOD CHAIN MAY:
1. BE INITIATED BY AN I-FIELD OR A T-FIELD AND
 2. CONTAIN A MIXTURE OF BOTH I-FIELD AND T-FIELD CHAINS.
- Active bit. This bit is cleared by CMPPU when the job is completed. If the programmer wants to use this bit, it must be set before the IOD is submitted.
- V. THIS FIELD IS ONLY USED WITH DISC WRITE IOD'S. WHEN THIS BIT IS A ONE, THE PPU WILL WRITE A SPECIFIED TWELVE-BIT DISC PATTERN IN A SPECIFIED DISC FILE. THERE IS A SPECIAL FORMAT FOR THE THIRD WORD OF THE IOD IN THIS CASE; SEE SECTION 9.5.9, PAGE 45, FOR FURTHER REMARKS.
- W. THIS BIT IS FOR SYSTEM PURPOSES AND MUST NOT BE USED BY A PROBLEM PROGRAM.
- X. MAY CONTAIN PARAMETERS RETURNED BY SLAVE PROGRAMS TO THE PROBLEM PROGRAM UPON COMPLETION OF THE JOB.
- Y. SPECIFIES SIZE OF CENTRAL MEMORY BUFFER.

9.4. FORMAT FOR INPUT/OUTPUT REQUESTS

2. SPECIFIES LOCATION OF CENTRAL MEMORY BUFFER.

9.4.2. REMARKS

.....

IT WILL BE NOTED THAT AN IOD MAKES NO DIRECT REFERENCE TO AN I/O DEVICE. THE REASON FOR THIS IS THAT IF A PROGRAM COULD REFER DIRECTLY TO AN I/O DEVICE, IT WOULD BE POSSIBLE FOR ONE PROGRAM TO INTERFERE WITH ANOTHER (BY WRITING IN THE OTHER'S DISC FILE, FOR EXAMPLE).

TO GET AROUND THIS DIFFICULTY, THERE IS ASSOCIATED WITH EVERY PROBLEM PROGRAM A BLOCK OF WORDS WHICH IS OUTSIDE THE PROGRAM'S MEMORY BOUNDS AND THUS NOT DIRECTLY ACCESSIBLE TO THE PROGRAM. FOR CONVENIENCE, THIS BLOCK OF WORDS IMMEDIATELY PRECEDES THE PROGRAM IN CORE. HENCE, WE CALL THIS BLOCK OF WORDS THE PROGRAM'S 'MINUS WORDS'.

WHEN A PROBLEM PROGRAM DESIRES TO USE AN INPUT/OUTPUT DEVICE, IT MUST REQUEST THE DEVICE FROM FROST AND SPECIFY A MINUS WORD TO BE ASSOCIATED WITH THAT DEVICE. IF THE DEVICE IS AVAILABLE TO THE REQUESTING PROGRAM, FROST WILL STORE INFORMATION WHICH DESCRIBES THE DEVICE IN THE MINUS WORD. THEREAFTER, WHEN THE PROBLEM PROGRAM WISHES TO USE THE DEVICE, IT WILL REFER IN THE IOD TO THE APPROPRIATE MINUS WORD. THE PPU CONCERNED WITH THE EXECUTION OF THE JOB WILL LOOK AT THE MINUS WORD TO SEE WHICH DEVICE IS TO BE USED. THUS, FOR THE PROBLEM PROGRAMMER, THE MINUS WORD NUMBER BECOMES A SYMBOLIC NAME FOR THE I/O DEVICE.

WITH SEVERAL PROGRAMS IN THE ALTERNATOR LOOP AT ONE TIME, CONFLICTING DEMANDS FOR USE OF THE I/O CHANNELS WILL ARISE. CMPPU, THEREFORE, MUST SCHEDULE I/O JOBS SO THAT CONFLICTS ARE AVOIDED.

FOR NON-DISC I/O, THE SCHEDULING IS VERY SIMPLE. FOR EACH NON-DISC CHANNEL CMPPU WILL MAINTAIN A LIST OF JOBS TO BE EXECUTED. EACH IOD IS PUT AT THE END OF THE LIST WHEN IT IS SUBMITTED. WHEN A CHANNEL BECOMES FREE, CMPPU WILL ASSIGN SLAVE PPU'S TO DO THE FIRST JOB IN THE LIST FOR THAT CHANNEL (PROVIDED THAT ENOUGH FREE PPU'S ARE AVAILABLE).

THIS MANNER OF SCHEDULING WOULD, HOWEVER, LEAD TO EXTREMELY INEFFICIENT USE OF THE DISCS, SINCE HEAD MOTION IS QUITE SLOW (195-260 MILLISECONDS). FOR THIS REASON, THE LIST OF JOBS FOR EACH DISC CHANNEL IS ORDERED ACCORDING TO THE HEAD POSITION WHERE THE JOB IS TO BE STARTED. ONCE THE HEADS ARE AT A GIVEN POSITION AND ARE PROCEEDING IN A GIVEN DIRECTION, ALL JOBS IN THAT DIRECTION (FROM THE CLOSEST TO THE FARTHEST) ARE EXECUTED BEFORE THE HEADS CHANGE DIRECTION. THIS HAS THE EFFECT OF ELIMINATING MUCH UNNECESSARY HEAD MOTION.

9.4. FORMAT FOR INPUT/OUTPUT REQUESTS

IT MAY BE A SLIGHT INCONVENIENCE TO THE PROGRAMMER THAT DISC JOBS ARE NOT NECESSARILY EXECUTED IN THE ORDER IN WHICH THEY ARE SUBMITTED, BUT THIS CONSIDERATION IS FAR OUTWEIGHED BY THE NECESSITY OF AVOIDING INEFFICIENT USE OF THE DISCS.

WITH SEVERAL PROGRAMS SHARING THE DISCS, IT IS NOT POSSIBLE FOR A PROGRAM TO REQUEST HEAD MOTION AND LATER REQUEST TO READ OR WRITE AND EXPECT THE HEADS TO BE IN THE PROPER POSITION. SINCE ALL DISC READ-AND-WRITE REQUESTS IMPLICITLY CONTAIN HEAD POSITION INFORMATION, IT IS NOT A HARDSHIP ON A PROGRAM IF THE HEADS ARE NOT IN POSITION WHEN A READ OR WRITE REQUEST IS MADE.

CMPPU determines whether one or two PPU's are assigned to a particular I/O request. One PPU is assigned to disk requests if the record comprises less than or exactly one sector and lies within one sector; otherwise two PPU's are assigned. (One sector is 64_{10} sixty-bit words.)

One PPU is assigned to binary tape read or write requests if the record comprises 512 or fewer control words; otherwise two PPU's are assigned. All tape function requests are assigned one PPU (e.g., rewind, space forward, etc.). BCD read or write tape requests are always assigned one PPU and accept a maximum record of 7202 characters.

Requests for dd80 are always assigned one PPU.

9.5. INPUT/OUTPUT PROGRAMS AVAILABLE

9.5.1. READ EVEN-PARITY (BCD) TAPE

AAAA = 0002 READ EVEN PARITY (BCD) TAPE

ONE ENTIRE RECORD IS READ EACH TIME THIS I/O PROGRAM IS USED. WHEN THE IOD IS COMPLETED, THE X-FIELD OF THE IOD WILL CONTAIN THE NUMBER OF TWELVE-BIT BYTES (THAT IS, THE NUMBER OF PPU WORDS) WHICH WERE TRANSMITTED TO CENTRAL MEMORY.

FIELD Y OF THE IOD SPECIFIES THE BUFFER LENGTH. THIS LENGTH IS INTERPRETED AS AN UPPER LIMIT ON THE NUMBER OF WORDS TO BE READ. THIS UPPER LIMIT WILL NEVER BE EXCEEDED BY THE I/O PROGRAM. THE MAXIMUM ALLOWABLE UPPER LIMIT IS 7202 CHARACTERS.

IF 'W' REPRESENTS THE NUMBER OF WORDS ACTUALLY IN A RECORD, ONE OF THREE CASES CAN RESULT:

- 1) $W = (\text{FIELD Y})$, AND $5*W$ IS IN FIELD X.
- 2) $W < (\text{FIELD Y})$, AND $5*W$ IS IN FIELD X.
- 3) $W > (\text{FIELD Y})$, AND $5*(\text{FIELD Y})$ IS IN FIELD X.

IN CASE 3, AN ERROR WILL BE SET INDICATING THAT THE BUFFER WAS NOT LARGE ENOUGH.

9.5.2. DISPLAY ON DD80

AAAA = 0014 DISPLAY ON dd80

FIELD G OF THE IOD IS OF THE FORM: 000000 00000T PPPPP PPPPP

WHERE:

- T IS THE TUBE ADDRESS AND IS SET AT THE BEGINNING OF THE OUTPUT DATA.
- | | |
|-----|---|
| T=0 | MEANS DO NOT CHANGE TUBE ADDRESS. |
| T=1 | MEANS SET THE TUBE ADDRESS FOR THE FIVE-INCH PRECISION TUBE ONLY. |
| T=2 | MEANS SET THE TUBE ADDRESS FOR THE VISUAL TUBE ONLY. |
| T=3 | MEANS SET THE TUBE ADDRESS FOR BOTH TUBES. |

PP...P IS THE NUMBER OF PPU WORDS TO BE SENT TO THE dd80. IF THE Y FIELD OF THE IOD IS GREATER THAN 600 DECIMAL, PP...P IS IGNORED AND THE Y FIELD IS USED AS THE NUMBER OF PPU WORDS TO BE SENT TO THE dd80.

The errors returned in the F field are:

- 0001 - DD80 not ready
- 0002 - DD80 in manual
- 0004 - Y field zero or too large or illegal DD80 word
- 0010 - DD80 film jam
- 0012 - DD80 Camera hung
- 0020 - DD80 film low
- 0100 - Channel failure

9.5. INPUT/OUTPUT PROGRAMS AVAILABLE

9.5.3. WRITE EVEN-PARITY (BCD) TAPE

AAAA = 0015 WRITE EVEN-PARITY (BCD) TAPE

IF FIELD G OF THE IOD IS ZERO, THE NUMBER OF SIXTY-BIT WORDS TO BE WRITTEN IS TAKEN FROM FIELD Y. IF FIELD G OF THE IOD IS NOT ZERO, THE NUMBER OF TWELVE-BIT WORDS TO BE WRITTEN IS TAKEN FROM FIELD G. FIELD G MUST NOT EXCEED FIVE TIMES FIELD Y. THE MAXIMUM BUFFER SIZE IS 7202 CHARACTERS.

IF A BAD SPOT IS ENCOUNTERED, THE RECORD WILL BE REWRITTEN UP TO SEVEN TIMES. IF THIS FAILS AND THE L BIT OF THE IOD IS ZERO, THEN ENOUGH TAPE WILL BE ERASED TO PRODUCE AN ERROR-FREE WRITE. IF, HOWEVER, A PARITY-FREE WRITE IS NOT EXECUTED AFTER A REASONABLE NUMBER OF TRIES (AT PRESENT, 105). IF THE TAPE IS NON-ERASABLE, OR IF THE END-OF-TAPE IS PASSED, THEN A PARITY-ERROR/END-OF-TAPE (0012) WILL BE STORED IN THE F FIELD OF THE IOD. AN END-OF-FILE WILL BE WRITTEN ON THE TAPE AND THE TAPE WILL BE BACKSPACED OVER THE END-OF-FILE. NOTE THAT THIS IS THE ONLY PARITY RETURNED WHEN L = 0.

9.5.4. SKIP RECORDS

AAAA = 0016 SKIP N RECORDS

G = 00NNNNNN = N RECORDS BACKWARDS. (MAXIMUM N = 377777 (OCTAL) = 131071 (DECIMAL))
 G = 40NNNNNN = N RECORDS FORWARDS. (MAXIMUM N = 377777 (OCTAL) = 131071 (DECIMAL))
 G = 60XXXXXX = SKIP FORWARD TO END-OF-FILE. X IS IGNORED.
 G = 70XXXXXX = SKIP BACKWARD TO END-OF-FILE. X IS IGNORED.

Note: This routine will return an error (for all four cases) if a filemark or end-of-tape or load point is encountered while skipping. Thus search filemark may be programmed by requesting the PPU to skip a large number of records and then recognizing the filemark error.

On a skip records the number of records actually skipped (up to and including the filemark or end-of-tape or load point) will be stored in the X field of the IOD at completion of the operation.

9.5.4(A). Display on G Machine Scopes

AAAA = 0017 Y=size of user's buffer, Z=location of user's buffer (see Paul Lund for details).

9.5.4(B). Read/Write Central Memory

AAAA-0025 D=0 means read, D=1 means write. G is the absolute address in central memory, Y is size of user's buffer, Z is location of user's buffer. Only "trusted" routines may use this call. The central buffer is limited to 512 words.

9.5. INPUT/OUTPUT PROGRAMS AVAILABLE

9.5.5. Illegal

AAAA = 0077

This is by definition an illegal job number. It is illegal as compared to undefined or not used. Certain "trusted" routines may use this number.

9.5.6. READ ODD-PARITY (BINARY) TAPE

AAAA = 0410 READ ODD-PARITY (BINARY) TAPE

ONE ENTIRE RECORD IS READ EACH TIME THIS I/O PROGRAM IS USED. WHEN THE IOD IS COMPLETED, FIELD G OF THE IOD WILL CONTAIN THE NUMBER OF TWELVE-BIT BYTES (THAT IS, THE NUMBER OF PPU WORDS) WHICH WERE TRANSMITTED TO CENTRAL MEMORY.

FIELD Y OF THE IOD SPECIFIES THE BUFFER LENGTH. THIS LENGTH IS INTERPRETED AS AN UPPER LIMIT ON THE NUMBER OF WORDS TO BE READ. THIS UPPER LIMIT WILL NEVER BE EXCEEDED BY THE I/O PROGRAM.

IF -W- REPRESENTS THE NUMBER OF WORDS ACTUALLY IN A RECORD, ONE OF THREE CASES RESULT:

- 1) $W = (\text{FIELD } Y)$, AND $5*W$ IS IN FIELD G.
- 2) $W < (\text{FIELD } Y)$, AND $5*W$ IS IN FIELD G.
- 3) $W > (\text{FIELD } Y)$, AND $5*(\text{FIELD } Y)$ IS IN FIELD G.

IN CASE 3, AN ERROR WILL BE SET INDICATING THAT THE BUFFER WAS NOT LARGE ENOUGH.

9.5. INPUT/OUTPUT PROGRAMS AVAILABLE

9.5.7. WRITE ODD-PARITY (BINARY) TAPE

AAAA = 0411 WRITE ODD-PARITY (BINARY) TAPE

IF FIELD G OF THE IOD IS ZERO, THE NUMBER OF SIXTY-BIT WORDS TO BE WRITTEN IS TAKEN FROM FIELD Y. IF FIELD G OF THE IOD IS NOT ZERO, THE NUMBER OF TWELVE-BIT WORDS TO BE WRITTEN IS TAKEN FROM FIELD G. FIELD G MUST NOT EXCEED FIVE TIMES FIELD Y.

IF A BAD SPOT IS ENCOUNTERED, THE RECORD WILL BE REWRITTEN UP TO SEVEN TIMES. IF THIS FAILS AND THE L BIT OF THE IOD IS ZERO, THEN ENOUGH TAPE WILL BE ERASED TO PRODUCE AN ERROR-FREE WRITE. IF, HOWEVER, A PARITY-FREE WRITE IS NOT EXECUTED AFTER A REASONABLE NUMBER OF TRIES (AT PRESENT, 105). IF THE TAPE IS NON-ERASABLE, OR IF THE END-OF-TAPE IS PASSED, THEN A PARITY-ERROR/END-OF-TAPE (0012) WILL BE STORED IN THE F FIELD OF THE IOD. AN END-OF-FILE WILL BE WRITTEN ON THE TAPE AND THE TAPE WILL BE BACKSPACED OVER THE END-OF-FILE. NOTE THAT THIS IS THE ONLY PARITY RETURNED WHEN L = 0.

9.5.8. DISC READ

AAAA = 0412 DISC READ

AT END OF OPERATION, THE X FIELD WILL CONTAIN THE CPU WORD COUNT FOR THIS READ.

IF G IS GREATER THAN THE FILE SIZE, ERROR 4004 (OUT OF BOUNDS DISC REFERENCE) WILL BE PLACED IN THE F FIELD AND THE PROGRAM WILL BE KILLED.

IF G IS NOT GREATER THAN THE FILE SIZE BUT G+Y IS, 0020 (END OF FILE) WILL BE PLACED IN THE F FIELD AND (FILESIZE-G) WILL BE PLACED IN THE X FIELD (THAT IS, THE NUMBER OF WORDS READ). THIS NUMBER WILL BE GREATER THAN ZERO, BUT NOT GREATER THAN Y. DATA UP TO THE END OF THE FILE WILL BE TRANSMITTED.

9.5. INPUT/OUTPUT PROGRAMS AVAILABLE

9.5.9. DISC WRITE

AAAA = 0413 DISC WRITE

IF THE V-FIELD IS ZERO, THIS I/O PROGRAM WILL WRITE SPECIFIED DATA ON DISC. AS EACH 64-WORD BLOCK IS WRITTEN, THE X FIELD IS UPDATED TO GIVE A DYNAMIC CPU WORD COUNT.

IF G IS GREATER THAN THE FILE SIZE, 4004 (OUT OF BOUNDS DISC REFERENCE) WILL BE PLACED IN THE F FIELD AND THE PROGRAM WILL BE KILLED.

IF G IS NOT GREATER THAN THE FILE SIZE BUT G+Y IS, 0020 (END OF FILE) WILL BE PLACED IN THE F FIELD AND (FILE:SIZE-G) WILL BE PLACED IN THE X FIELD (THAT IS, THE NUMBER OF WORDS WRITTEN). THIS NUMBER WILL BE GREATER THAN ZERO, BUT NOT GREATER THAN Y. DATA UP TO THE END OF THE FILE WILL BE TRANSMITTED.

IF THE V-FIELD IS A ONE, THE PPU WILL WRITE A SPECIFIED TWELVE-BIT PATTERN INTO ANY SPECIFIED PORTION OF THE DISC FILE. THE THIRD WORD OF THE IOD HAS A SPECIAL FORMAT FOR THIS CASE, GIVEN BY

-GGGGGGGGGG GGGGGGGGGGG PPPPPPPPPPP ----YY YY YYY YYY YYY YYY YYY,

WHERE

GG...G IS THE FIRST DISC WORD ADDRESS FOR THE WRITE OPERATION.

PP...P IS THE TWELVE-BIT PATTERN TO BE WRITTEN IN THE DISC FILE.

YY...Y IS THE NUMBER OF SIXTY-BIT WORDS TO BE FILLED WITH THE DESIRED DISC PATTERN
PP...P.

THIS USE OF THE 'DISC WRITE' I/O PROGRAM ALLOWS A PROBLEM PROGRAM TO CLEAR ALL OR PART OF A DISC FILE, OR TO WRITE A DISC PATTERN IN THE DISC FILE, WITHOUT CREATING A BUFFER IN THE PROBLEM PROGRAM'S OWN STORAGE.

9.5. INPUT/OUTPUT PROGRAMS AVAILABLE

9.5.10. READ TAPE UNIT STATUS

AAAA - 2000

READ TAPE UNIT STATUS

THE TAPE UNIT STATUS IS RETURNED IN THE Z-FIELD OF THE IOD. MULTIPLE STATUS STATES ARE LOGICALLY ADDED TOGETHER; FOR EXAMPLE, 0005 INDICATES: 1) THE TAPE UNIT IS READY. 2) THERE IS A RING IN THE TAPE. 3) THE TAPE UNIT IS SET TO 200 BPI.

XXX1 READY.
XXX2 BUSY.
XXX4 WRITE ENABLE (THERE IS A RING IN THE TAPE).
XX1X FILEMARK.
XX2X LOAD POINT.
XX4X END OF TAPE.
X0XX DENSITY 200 BPI.
X1XX DENSITY 556 BPI.
X2XX DENSITY 800 BPI.
X4XX LOST DATA.
1XXX END-OF-OPERATION.
2XXX PARITY ERROR.
4XXX RESERVED BY OTHER CHANNEL.

9.5.11. REWIND

AAAA - 2001

REWIND

9.5.12. REWIND UNLOAD

AAAA - 2002

REWIND UNLOAD

9.5. INPUT/OUTPUT PROGRAMS AVAILABLE

9.5.13. WRITE FILEMARK

AAAA = 2003 WRITE FILEMARK

9.5.14. SET DENSITY TO 200 BPI

AAAA = 2010 SET DENSITY TO 200 B.P.I.

9.5.15. SET DENSITY TO 556 BPI

AAAA = 2011 SET DENSITY TO 556 B.P.I.

9.5.16. SET DENSITY TO 800 BPI

AAAA = 2012 SET DENSITY TO 800 B.P.I.

9.6. ERROR INDICATIONS

9.6.1. NOTES ON THE OPERATION OF I/O PACKAGES
.....

WHEN A PARITY ERROR IS ENCOUNTERED READING A BINARY TAPE, SEVEN ATTEMPTS ARE MADE TO READ THE RECORD CORRECTLY. IF A SUCCESSFUL READ CANNOT BE MADE, THE TAPE IS LEFT POSITIONED ON THE FAR SIDE OF THE BAD RECORD. THE INFORMATION IN THE RECORD IS LEFT IN CENTRAL MEMORY FROM THE LAST ATTEMPT.

BCD TAPE ROUTINES ALLOW FOR A MAXIMUM BUFFER SIZE OF 7202 CHARACTERS. THIS ALLOWS THE PROGRAM TO PUT OUT RECORDS EQUAL IN SIZE TO A RADIATION-PRINTER PAGE PLUS THE PAGE-RESTORE CHARACTER (OCTAL 16). THE PRESENCE OF THIS CHARACTER ANYWHERE IN A RECORD CAUSES THE RADIATION PRINTER (AND SC-5000) TO SPACE TO THE TOP OF THE NEXT PAGE ON ENCOUNTERING THE END OF THAT RECORD.

ALL TAPE ROUTINES WHICH READ OR WRITE TAPE ARE SINGLE-RECORD ROUTINES.

THE TAPE-READ ROUTINES READ UNDER RECORD CONTROL. THAT IS, THE PPU READS A SINGLE RECORD AND TRANSMITS IT TO CENTRAL MEMORY. FOR BCD TAPES THE MAXIMUM RECORD THAT CAN BE READ IS 7202 CHARACTERS. IF THE NUMBER OF CPU WORDS IN THE RECORD IS GREATER THAN THE SIZE OF THE BUFFER SPECIFIED IN THE IOD, THE PPU WILL TRANSMIT AS MANY WORDS TO CENTRAL MEMORY AS WILL FIT, AND WILL SIGNAL AN ERROR (0004).

9.6.2. STANDARD I/O ERROR MESSAGES
.....

THE FOLLOWING VALUES ARE PLACED IN THE F FIELD OF THE IOD AS THE OCCASION DEMANDS.

- 0000 - NO ERRORS.
- 0001 - DEVICE NOT READY OR RESPONDING TO STATUS REQUEST.
- 0002 - PARITY ERROR.
- 0004 - DATA EXCEEDS PROGRAMMER'S BUFFER.
- 0010 - END OF TAPE.
- 0020 - END-OF-FILE CONDITION.
- 0040 - ATTEMPT TO WRITE FILE-PROTECTED TAPE OR READ-ONLY DISC FILE.
- 0100 - CHANNEL FAILURE.
- 0200 - LOST DATA ON TAPE RECORD.
- 0400 - ATTEMPT TO BACKSPACE OVER LOAD POINT.

IN THE EVENT OF MORE THAN ONE ERROR, THE ABOVE NUMBERS ARE LOGICALLY ADDED TOGETHER.

9.6. ERROR INDICATIONS

4001 = DEVICE NOT ASSIGNED TO PROBLEM PROGRAM (VACUOUS OR IMPROPER MINUS WORD).
 4002 = OUT-OF-BOUNDS MEMORY REFERENCE.
 4004 = OUT-OF-BOUNDS DISC REFERENCE.
 4006 = ILLEGAL IOD.

7XXX = ILLEGAL A-FIELD IN IOD REQUEST. A-FIELD REQUESTED IS 'XXX'.

Note that all errors greater than 4000 are programmer errors. They are considered irremediable by FROST and will cause the I/O request to be terminated unconditionally. *(13)* If bit P (see 9.4.1) is zero, the user's program will be killed. If P is one, the user will get control and must examine the upper bit in the error field to determine if the I/O request was fatal.

9.6.3. MISCELLANEOUS PP ERROR MESSAGES

THE FOLLOWING CODES MAY APPEAR ON THE TELETYPE IMMEDIATELY IN FRONT OF THE 'ALL DONE' MESSAGE. EACH CODE INDICATES THAT THE PROBLEM PROGRAM HAS BEEN KILLED (THAT IS, REMOVED FROM THE ALTERNATOR LOOP) AND PLACED BACK ON DISC.

MISCELLANEOUS PROBLEM PROGRAM ERRORS NOT INVOLVING AN IOD.

200 PROBLEM PROGRAM MADE OUT-OF-BOUNDS MEMORY REFERENCE OR AN ILLEGAL FROST SYSTEM CALL. THESE TWO ARE INDISTINGUISHABLE.
 201 PROBLEM PROGRAM REQUESTED TO RETURN FROM AN INTERRUPT WHEN ALREADY AT THE MAIN PROGRAM LEVEL.
 202 illegal CMPPU system call.
 203 EXCHANGE-JUMP-REQUEST WORD (WORD ZERO) POINTS OUT-OF-BOUNDS.
 204 INPUT/OUTPUT REQUEST WORD (WORD ONE) POINTS OUT-OF-BOUNDS.
 205 TOO MANY IOD'S LISTED WHEN ADDING PROBLEM PROGRAM TO THE ALTERNATOR LOOP.
 206 IOD ADDRESS IS OUT OF BOUNDS WHEN ADDING PROBLEM PROGRAM TO ALTERNATOR LOOP.
 207 PROBLEM PROGRAM CALLED FOR TOO MANY EXCHANGE JUMP PACKAGES.

 (13) SIMILAR ACTION RESULTS FOR ERRORS 0002 (WHILE WRITING DISC) AND 4007.

9.6. ERROR INDICATIONS

ERRORS WHICH INVOLVE AN IOD.

- 300 INCORRECT MINUS WORD--ILLEGITIMATE CHANNEL NUMBER.
- 301 ILLEGAL A-FIELD (MPPU-JOB).
- 302 MINUS WORD HAS WRONG UNIT TYPE (MPPU-JOB).
- 303 T-FIELD OF IOD POINTS OUT-OF-BOUNDS.
- 304 PROBLEM PROGRAM HAS SUBMITTED TOO MANY IOD'S (MORE THAN 31 DECIMAL).
- 305 PROBLEM PROGRAM HAS SUBMITTED TOO MANY IOD'S FOR ONE DEVICE (MORE THAN FIFTEEN).
- 306 PROBLEM PROGRAM ERROR DETECTED BY SLAVE PPU WHILE EXECUTING AN IOD. EXAMINE FIELD F OF THE IOD.
- 307 ADDRESS OF CONTINGENT IOD IS OUT-OF-BOUNDS.
- 310 INTERRUPT ADDRESS IS OUT-OF-BOUNDS.

Appendix A

Minus Word Formats

The "minus words" described pertains to that block of 256 (400 octal) words added prior to every problem program's relative word 0 (zero). These words are not accessible to the executing program.

A Word 0 -- Usually the name of the problem program in ASCII -- not looked at or used by Frost.

B Word 1 -- Consists of four fields, three of which Frost looks at.

59 FREEP 42 41 30 29 CUREX 12 11 NXJP 0

where:

NXJP -- number of exchange packages. This is usually 1 upon startup of execution.

CUREX -- a relative pointer to the current exchange package within the minus words. Should be zero upon start-up of execution and is filled in by Frost. If it is zero. Frost assumes the first exchange package to be located at word 2. If it is not zero, Frost assumes it is indeed a pointer to the current exchange package.

FREEP -- a relative pointer to the first free exchange package area. Exchange packages areas are 18 words in length and up to 9 exchange packages can be stored in the minus words. FREEP should be zero upon startup of execution and if so, it is filled in by Frost to point to word 20. The assumption made is only one exchange package at startup execution; therefore, the second exchange package area at word 20 is free. If not zero, Frost assumes this is a pointer to the first free area.

C Words 2-19; 20-37; 38-55; 56-73; 74-91; 92-109; 110-127; 128-145; 146-163--
Are exchange package areas -- 18 words each as follows:

Word 1: (Sometimes referred to as the 17th exchange package word.)

	XJA				IOST	GBST	DISS				C	0
59	42	41	39	38	37	36	35	28	27	24	23	

Where:

XJA -- a pointer to either next exchange package to be executed or next free exchange package area depending on whether this one is free or in use.

IOST -- If this bit is on, this exchange package is I/O stuck.

GBST -- If bit is on, this exchange package is GOB-Stuck (i.e., wishes to make a system call, but is prohibited from doing so until I/O has completed.) True for a certain class of system calls.

DISS -- A bit, if on, indicating this exchange package is disabled, i.e., usually an exchange package for an I/O interrupt routine and the disabled bit on says do not interrupt this exchange package with a new one. If bit is off, then a new exchange package (usually the result of another completed I/O operation) can interrupt this one.

C -- iod number (1-17 octal), if any, associated with this exchange package (again apt to be an I/O interrupt exchange package). This iod number taken from the C field in Word 1 of an iod.

Word 2: Contents of Word 0 (zero) of the problem program the last time it was executing.

WORD 3 -- starts the 16 word exchange package of registers, etc.
BITS 53-36 P Counter
BITS 35-18 A0 Address Register
BITS 17-0 B0 Index Register

WORD 4 -- BITS 53-36 Relative address
BITS 35-18 A1 Address Register
BITS 17-0 B1 Index Register

- WORD 5 -- BITS 53-36 EXLT Mode Register
 BITS 35-18 A2 Address Register
 BITS 17-0 B2 Index Register
- WORD 6 -- Thur Word 10
 BITS 35-18 A3 through A7 Address Register
 BITS 17-0 B3 through B7 Index Register
- WORD 11 -
- WORD 18 -- X0 through X7 operand registers
- D Word 192 -- ASCII BCD word - STACKED IOD
- E Words 193, 194 -- Used by Frost for restacking iod's.
- F Words 195 - 223 -- Relative pointers to iod's not yet issued, but already requested by the problem program.
- G Words 224- 239 -- ASCII BCD names of files (tape and/or disc) associated with words 240-255 in a one to one correspondence.
- H Words 240- 255 -- Commonly referred to as "Minus Words 15 through 0." These are the minus words pointed to in an iod and describe the I/O device. Word 255 = Minus Word 0; Word 254 = Minus Word 1, etc. These words are formatted as follows.

DISC	A	B	C	D	E	F
	59	57 56 55	53 52	48 47	24 23	0

Where A = 0 read only

A = 1 read/write

B = 0 not a pool file

B = 1 pool file

C = access information level

D = channel number

E = absolute first word disc address of file

F = size of file which is 100(8) words longer than user knows.

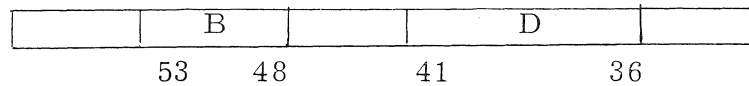
TAPE

	B	C	
	54	48 47	24

where B = channel number

C = unit number (0-7)

6600 System Calls and I/O Requests CIC-LTSS-9-ED.3

DD80 or
Console

where B = channel number

D = 10(8) console

D = 11(8) dd80

PACK

A	B	C	D	E	F	G	H	
59	58 57	56	55 53	52	48 47	24 23	21 20	0

A = 0 pack file

= 1 pack unit

B = 0 Read only

= 1 read/write

C = 0 not pool file

= 1 pool file

D access information level

E channel number

F absolute first word disk address of file

G physical unit

H size of file (100_8 words longer than the user specified).

Appendix B

Formats for Tables in Call 24NN (p. 27).

File Index Table (4 words/file, maximum 1088 files)

Word 1	FILENAME								60 bits							
Word 2	USERNO			20	EXTRA		16	SIZE		24						
Word 3	CH	6	BEGIN	24	LOC	6	TR	6	AV	6	UN	3	AC	3	DV	6
Word 4	LASTREF				24	FR		6	NOREF		15	HASH				15

where:

FILENAME = Name of file, ASCII BCD, right justified

USERNO = Binary user number

EXTRA = Number of words of extra disk space assigned
(minimum disk space = 500_8 words)SIZE = Number of words in file (addressable space + 100_8
words for ID sector)

CH = channel

BEGIN = First word of disk address

LOC = 1 if read/write; = 41_8 if read only; = 2 if execute only

TR = Trust status

AV = available

UN = pack unit

AC = $\emptyset$ if global; = 1 if restrictedDV $\neq$ 0 means divisional file and contains division number.LASTREF = Time file last referenced (i.e., opens and system
dumps). Kept for purge purposes. Contains micro-
second clock contents divided by $2^{**}24$.

FR = Protection level of file

NOREF = Number of references made to file (opens NOT reads and writes)

HASH = HASH index number (for search purposes)

Correspondence Table (2 words/entry, 14 entries)

- Entry 1 - Console assignment
- Entry 2 - DD80 assignment
- Entry 3 - User-1 DD80 tape, unit B
- Entry 4 - User-1 CRT tape, unit C
- Entry 5 - User-1 HSP tape, unit D
- Entry 6-10 - Tape drives for units E thru I respectively
- Entry 11 - G machine scope J
- Entry 12 - G machine scope K
- Entry 13 - G machine unit L
- Entry 14 - G machine unit M

Format for each entry:

Word 1	T 2	U 4	CN 12	G 2	MN 4	VNAME 36
Word 2	not used 45				DESC 15	

where:

- T = Type of device
- U = Physical unit number
- CH = Channel number
- G = Give status
- MN = Minus word pointer
- VNAME = Device name, ASCII BCD (i.e., name by which device assigned by operator)
- DESC = $\emptyset$ device is free; $\neq \emptyset$ points to descriptor block of owner

Disk Map Table (3 sections, 341_{10} words/section)

- 1st section - disk cabinet 0
- 2nd section - disk cabinet 1
- 3rd section - disk cabinet 2

This table catalogues free space only. A zero entry indicates end of information for the particular disk cabinet. Format of each word is:

LEN	30	FWA	30
-----	----	-----	----

where: LEN = length of free space

 FWA = starting disk address of free space